

The BIG Project

Creating, Provisioning, Deploying, and Managing
NET Services

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BIG Mission

Define a software architecture for
*creating, provisioning, deploying and
managing* Internet-scale .NET services.

- Target Services with:
 - Millions to 100's of Millions of Users
 - 1000's to 100s of 1000s of simultaneous Users
 - 100s to 100s of 1000s of Machines.

BIG Mission

Define a software architecture for
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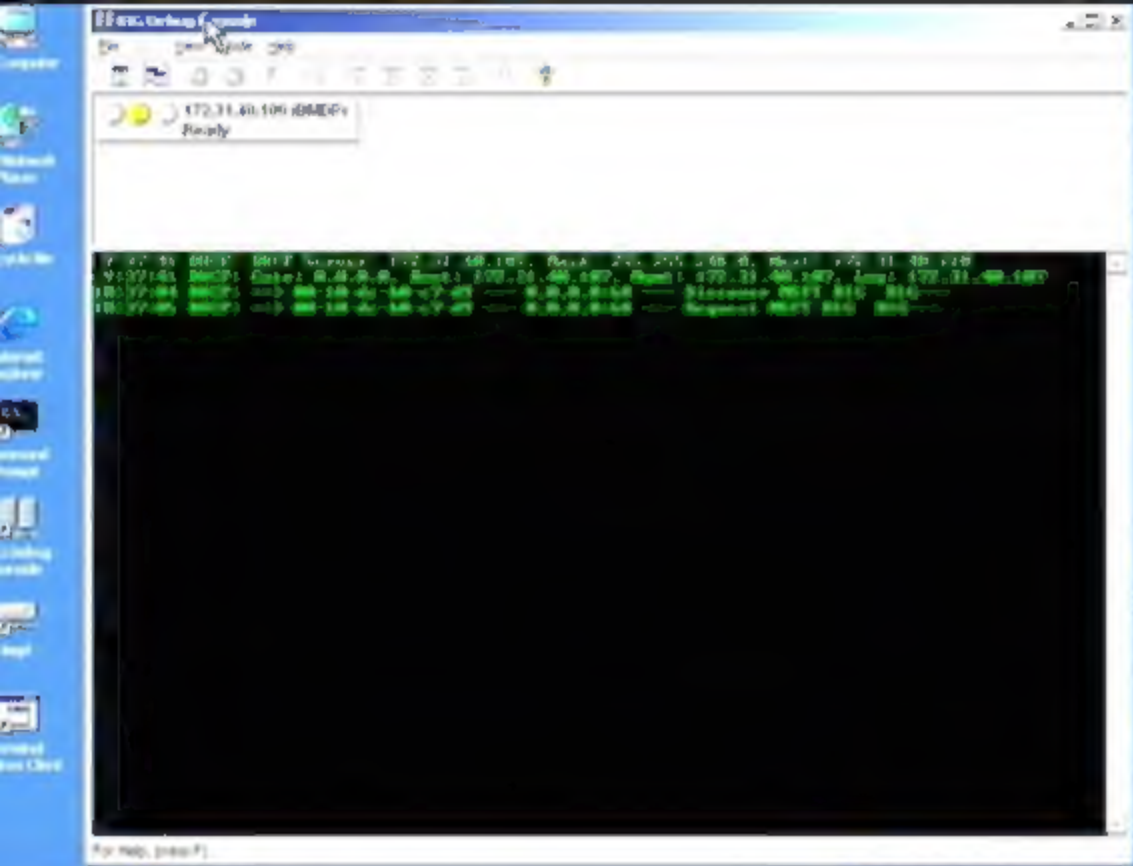
- Target Services with:
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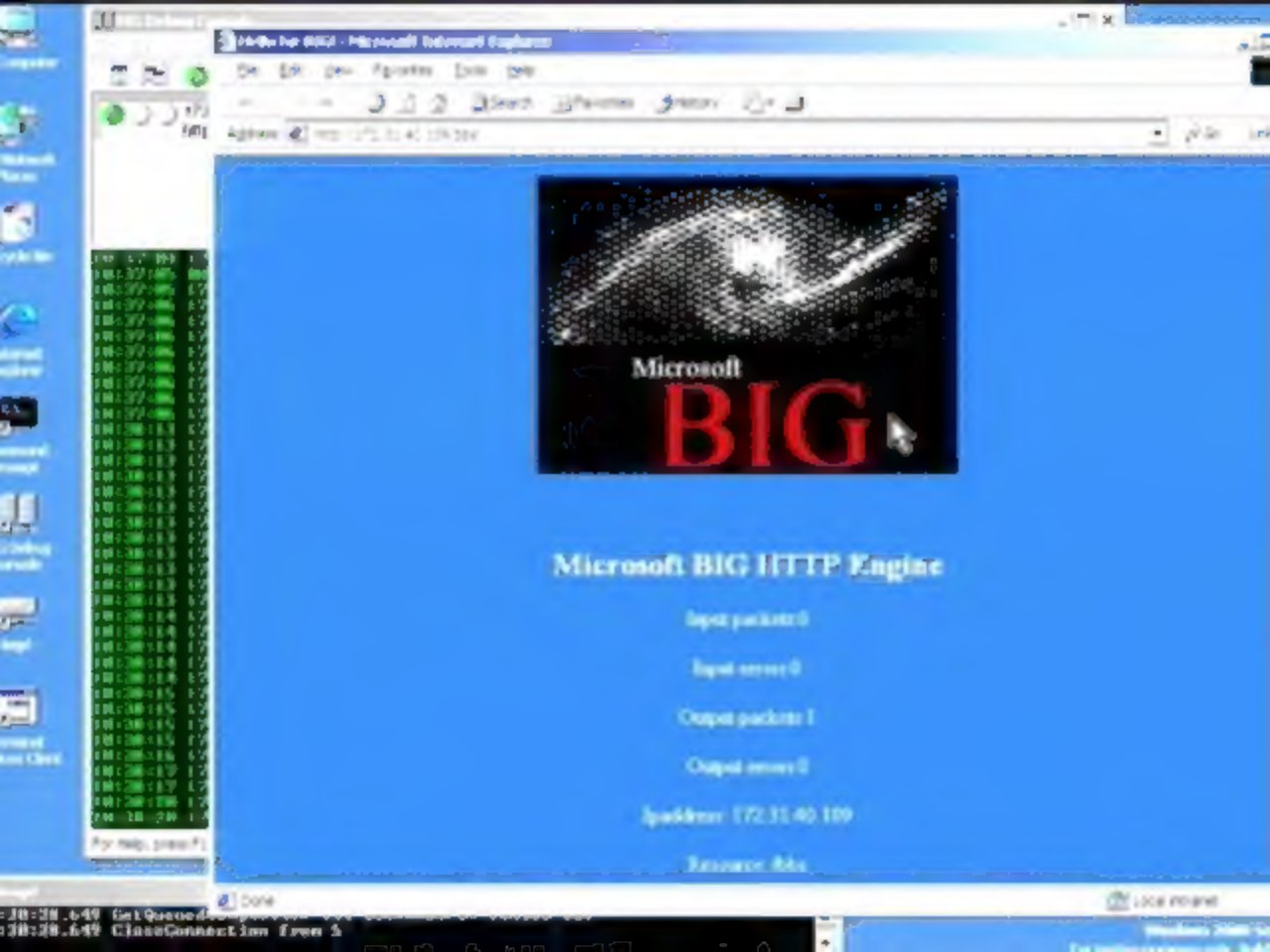
Cluster Management Starts with The Node

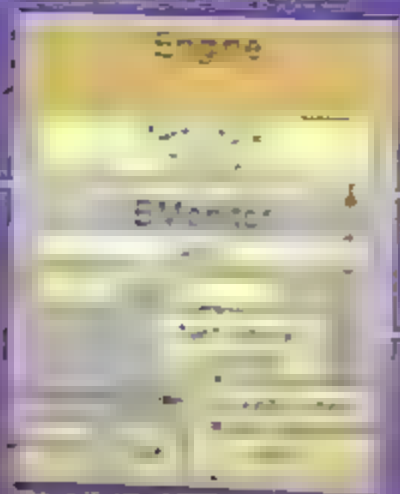
- Simple single-node management is crucial.
 - Completely hands-off, remote administration.
 - All administration through IP protocols.
 - Bare machine → running system image.
 - Fast as possible (support fast-fail, fast-recovery model).
- **BMonitor**: Single-node building block.
 - Fits in 64KB of FLASH.
 - Supports IP, UDP, DHCP, TFTP, & BMCP.
 - Filters all network traffic.
 - Always up, always manageable.

Single Node Demo

```
osoft BIG B-Monitor.  
ion 0.3 [debug i386 galenb@ oct 31 2000 09:59:20]  
les: [bm i810 ei806 ide basics]  
  
ature GUID: {a00758ca-4015c969-155f0a03-4ae4e405}  
essor 600MHz GenuineIntel x86 Family 6 Model 8 Stepping 1  
lable Physical Memory = 128 MB  
21.0 Version: 02.10, Buses: 2, Mechanism: 1  
  
512KB MB Flash  
Intel 8522B NIC, MAC=00-10-4c-b8-c7-49 IO=0xc000, IRQ=0x1  
IP starting DHCP for 00-10-4c-b8-c7-49  
  
No RK running.  
If 0, Ip 172.31.40.109/255.255.240.0 Gate 0.0.0.0 Dhcp 172.31.40.107
```







Electronics



Mathematics



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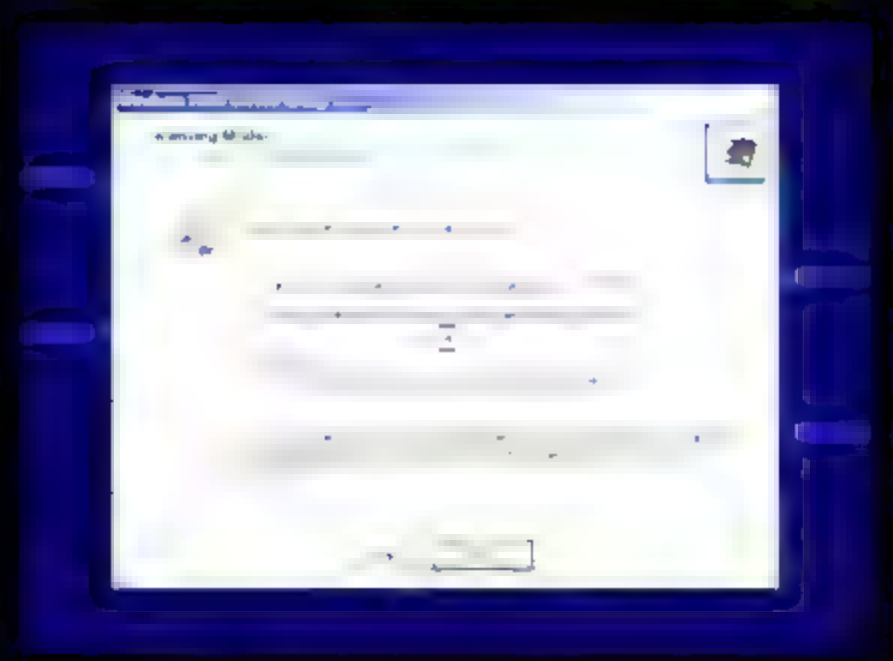
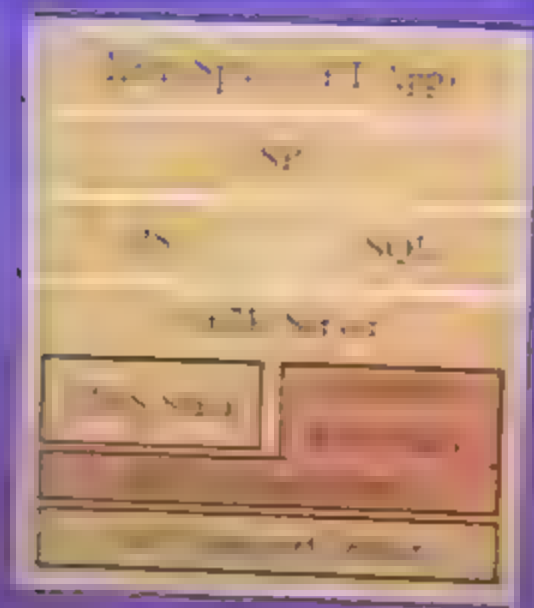
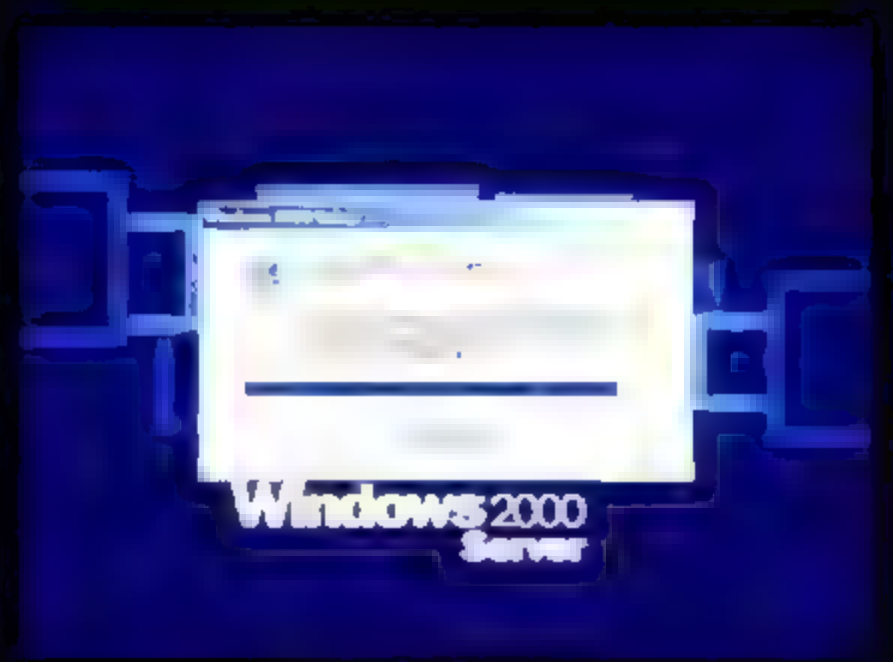


PLATE 10





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NUDE

Microsoft

BIG

How to write a good paper

1. Introduction

The purpose of this paper is to discuss the importance of writing a good paper. It will cover the following points:

- 1.1 The importance of writing a good paper
- 1.2 The importance of writing a good paper

2. The importance of writing a good paper

Writing a good paper is important for several reasons. First, it helps you to organize your thoughts and ideas. Second, it helps you to communicate your ideas to others. Third, it helps you to develop your writing skills. Fourth, it helps you to learn from others. Fifth, it helps you to improve your research skills. Sixth, it helps you to develop your critical thinking skills. Seventh, it helps you to develop your problem-solving skills. Eighth, it helps you to develop your communication skills. Ninth, it helps you to develop your leadership skills. Tenth, it helps you to develop your teamwork skills.

Conclusion

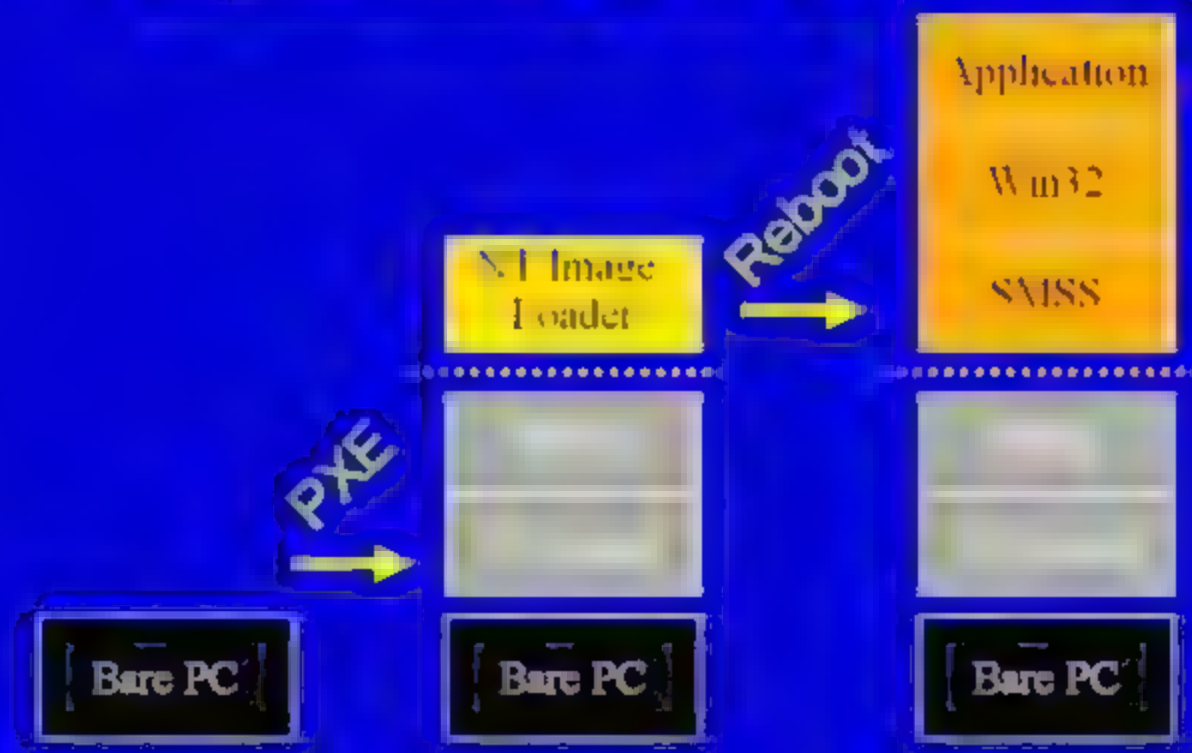
THE HISTORY OF THE CITY OF BOSTON

FROM THE FIRST SETTLEMENT
TO THE PRESENT TIME
BY
JOHN H. COLEMAN
OF THE
CITY OF BOSTON
IN TWO VOLUMES
VOL. I.
BOSTON:
PUBLISHED BY
J. B. LEECH, 15 N. BOSTON ST.
1855.

Node Management Revisited

- **NT BMonitor**: Single-node building block
 - Boots over network using PXE
 - Runs exclusively from RAM
 - Full Win2K IP Networking support + BMCP
 - Full Win2K Disk support
 - Filters all network traffic
 - Always up, always manageable

Deployment w/ NT BMonitor



NT Image Deployment

NT BMonitor

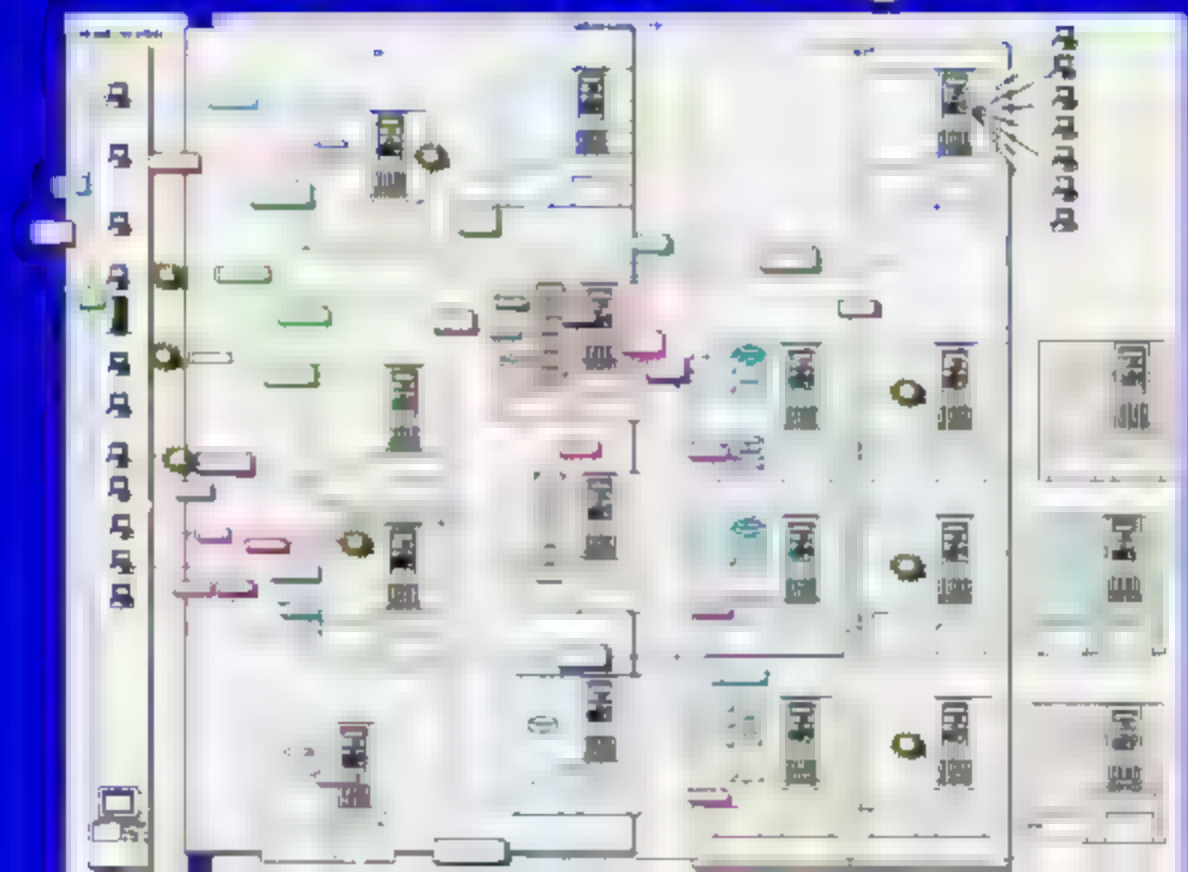
Management

Node

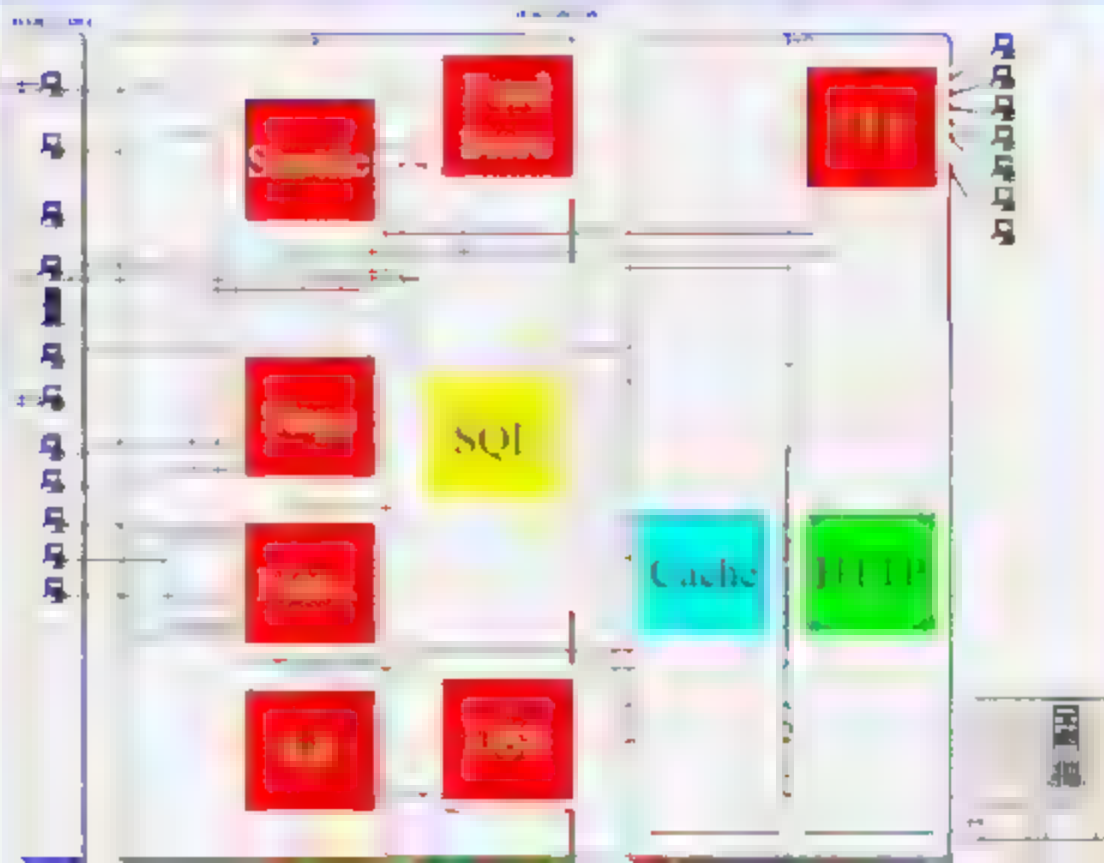
Service



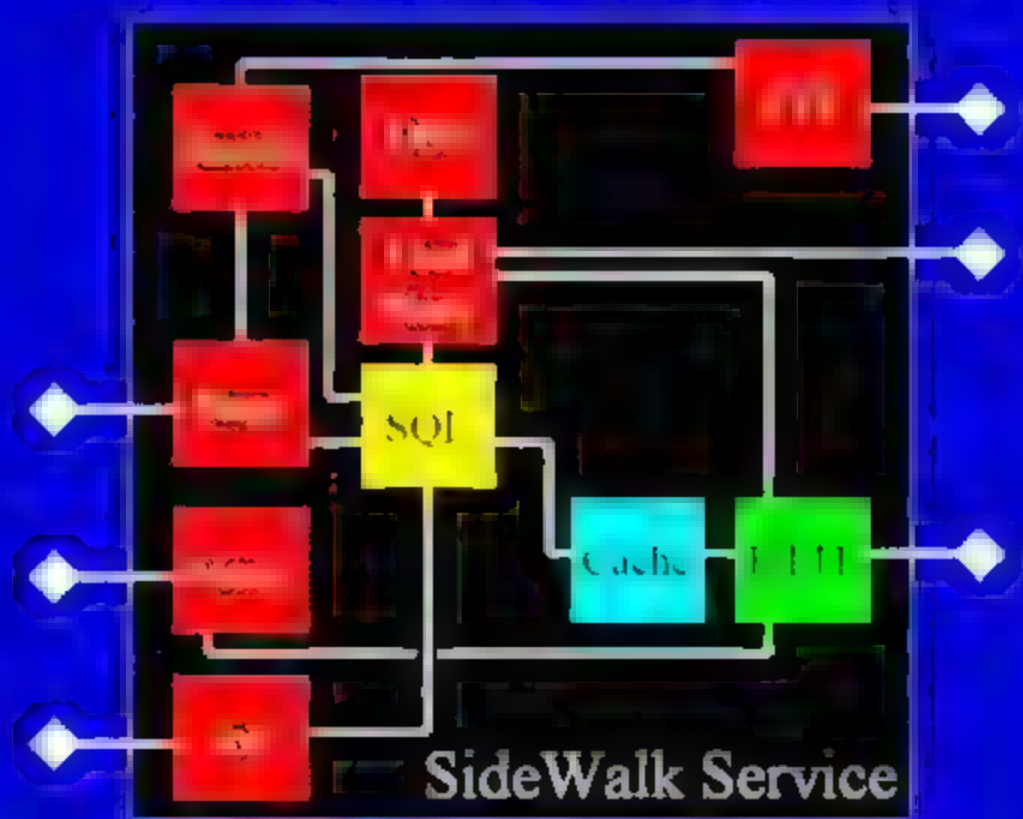
SideWalk Visio Diagram



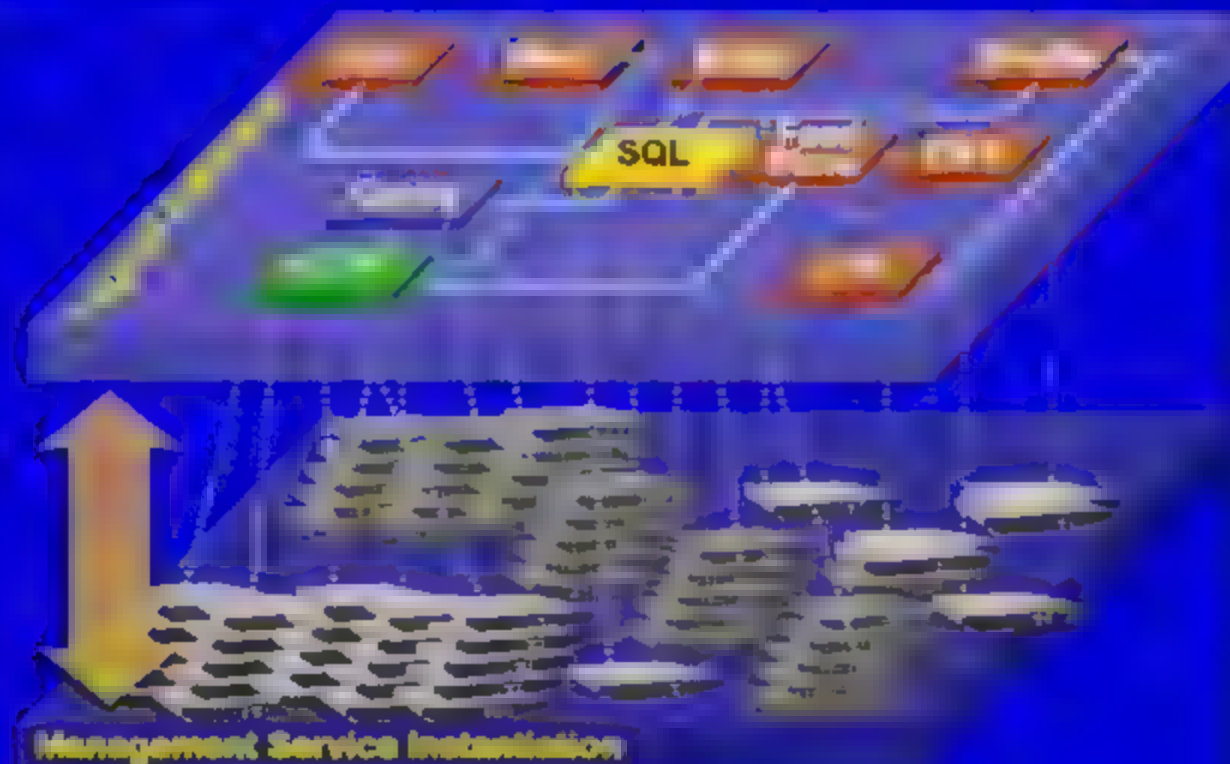
Scale-invariant Service Definition



Scale-invariant Service Definition



Deployment: Logical to Physical Mapping



Management: Automating Policy

- Policy as code:

- Operates on instances through scale-invariant Service Definition.

- Management Service APIs for

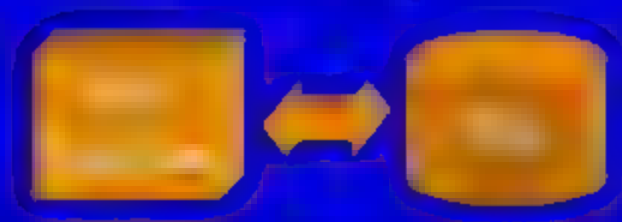
- Resource management for diverse device allocation.

- Creating and evolving Service Definitions.

- Instance State tracking

- Node coordination primitives.

IBuySpy



• NET demo service (from Microsoft PDC)

Typical eCommerce site.

Excellent demonstration of .NET framework power.

• ASP+ Frontend:

ASP/HTML UI, Cookies, Middle-tier business objects.

• SQL Backend contains:

Products, reviews, shopping carts, customers and orders.

IBigBuySpy



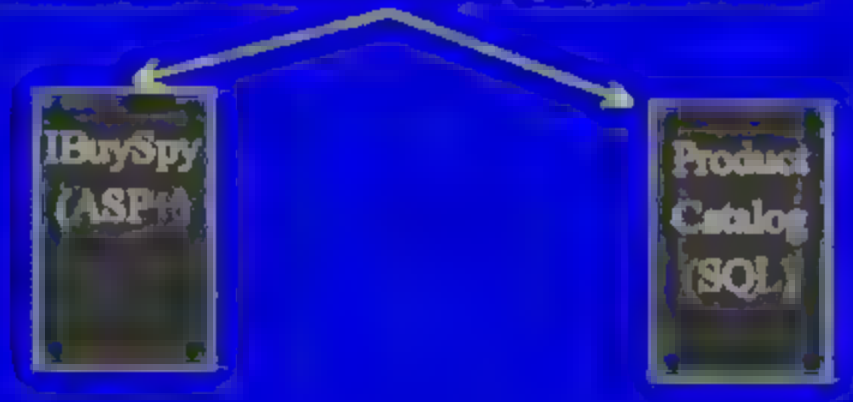
- More scalable implementation
 - Representative of dot-com deployment.
- Add policy to scale and manage the service.

Creating a Service

- A Service is comprised of:
 - *multiple nodes,*
 - *network topology,*
 - *operations processes, and*
 - *management policy.*
- In BIG, we capture these qualities with a **Service Definition.**

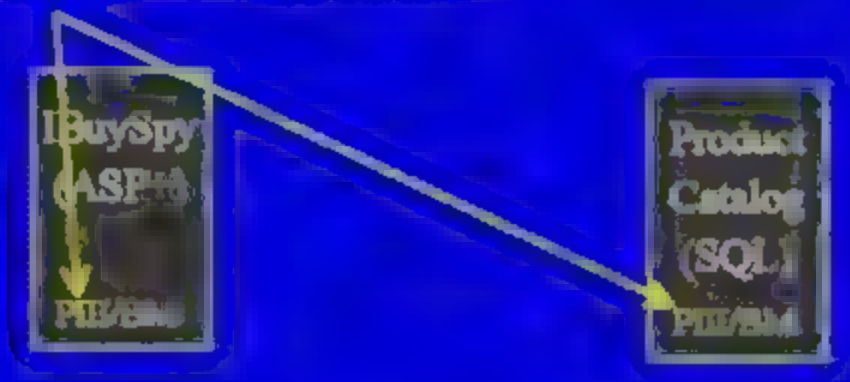
Service Definition

A component is a complete description of the code that should run on a physical node.



Service Definition

A component specifies the type of node it requires for deployment.

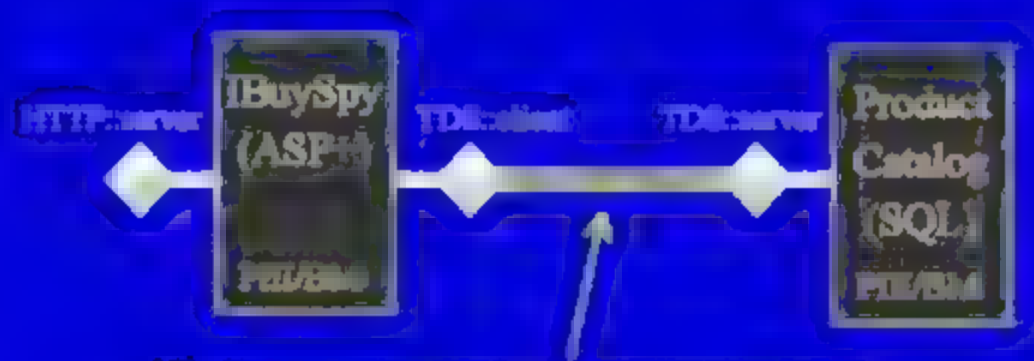


Service Definition

A port is typed with a protocol and role

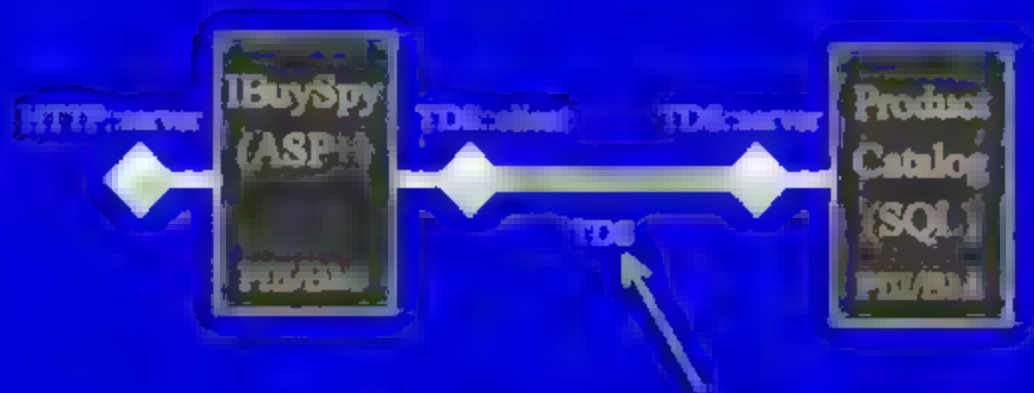


Service Definition



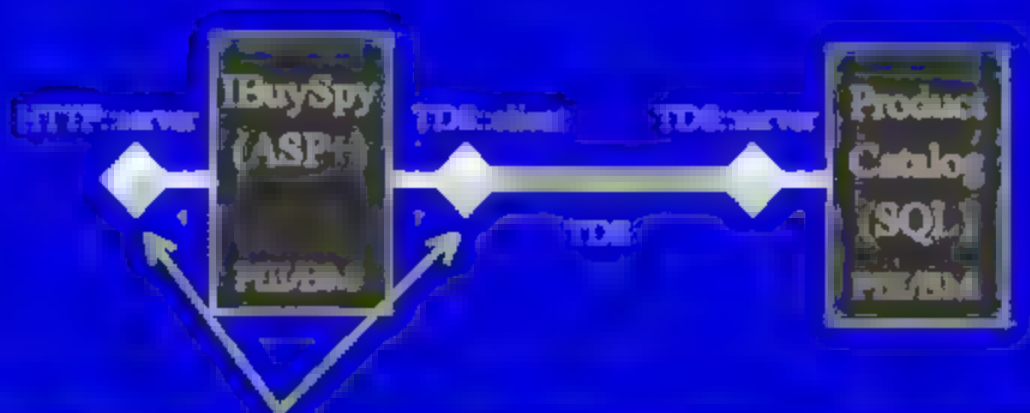
A wire represents a communication relationship between ports.

Service Definition



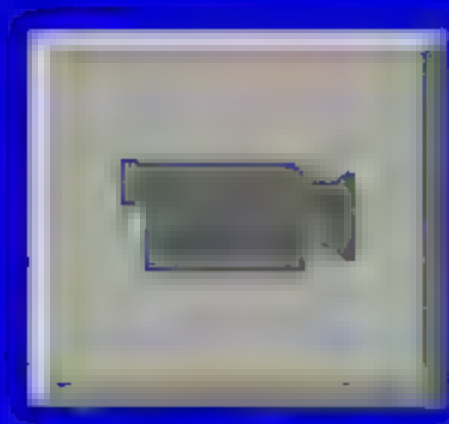
A wire is typed with a protocol.

Service Definition

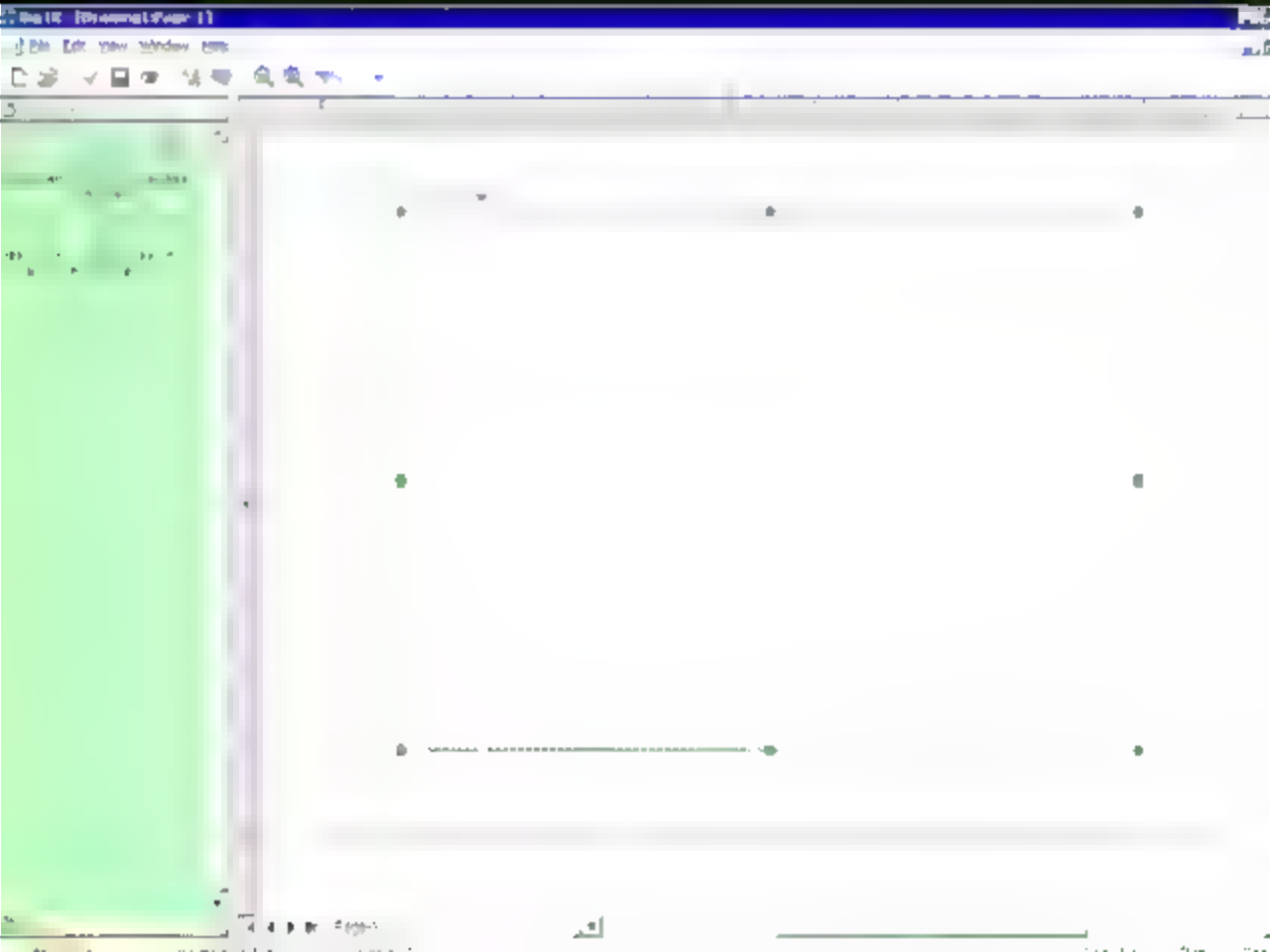


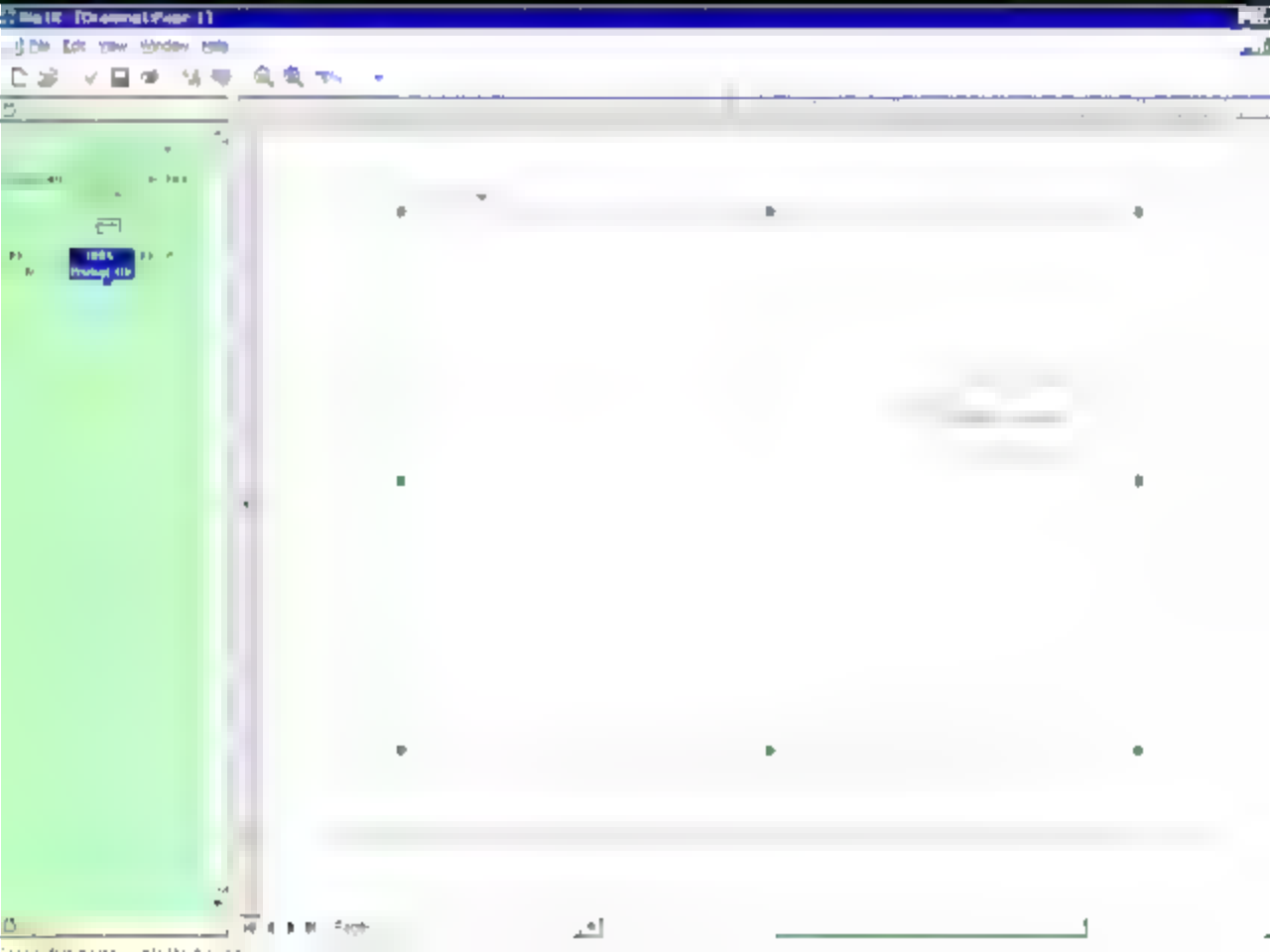
Ports define a component's operational namespace.

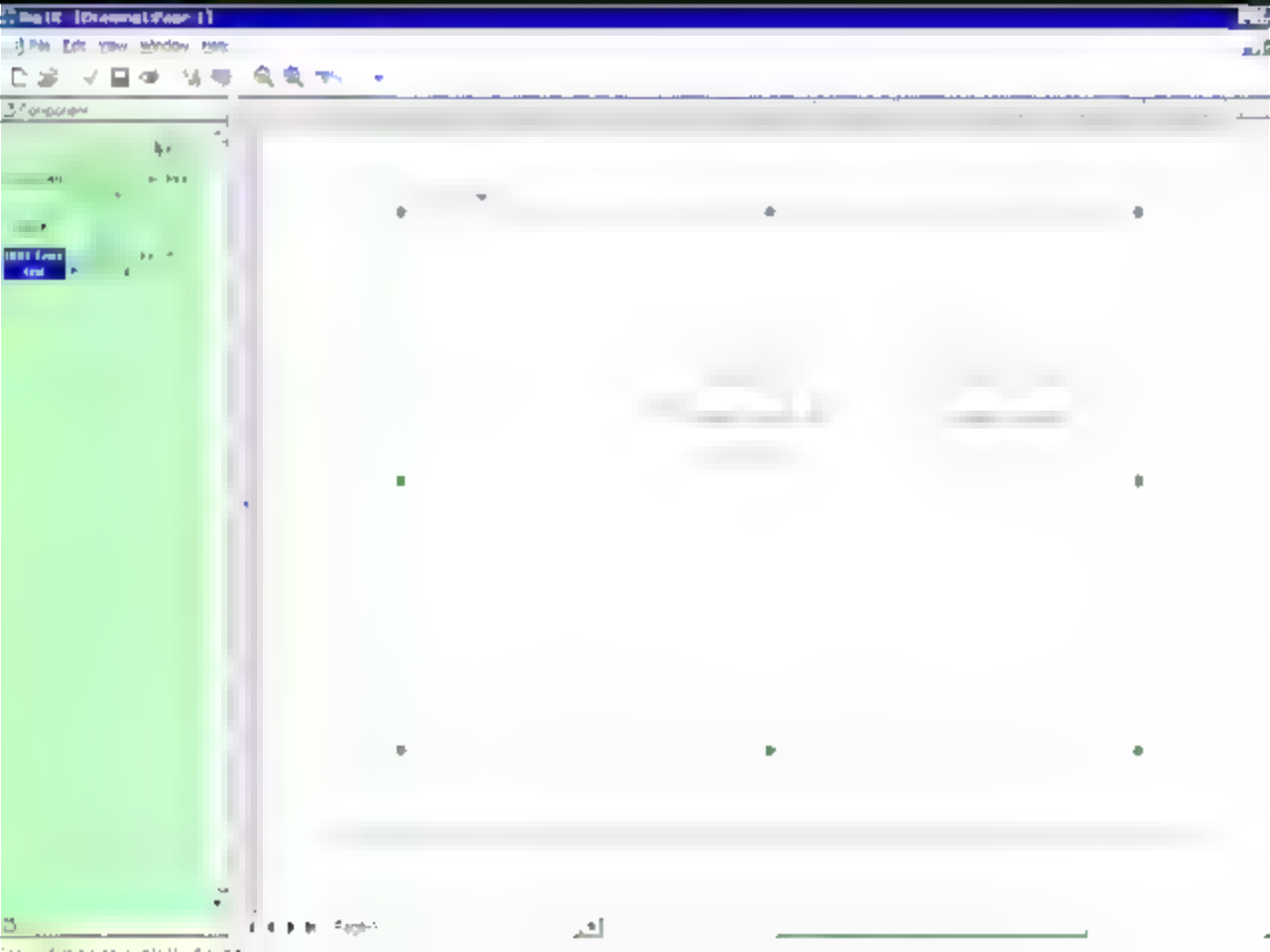
Creation Demo

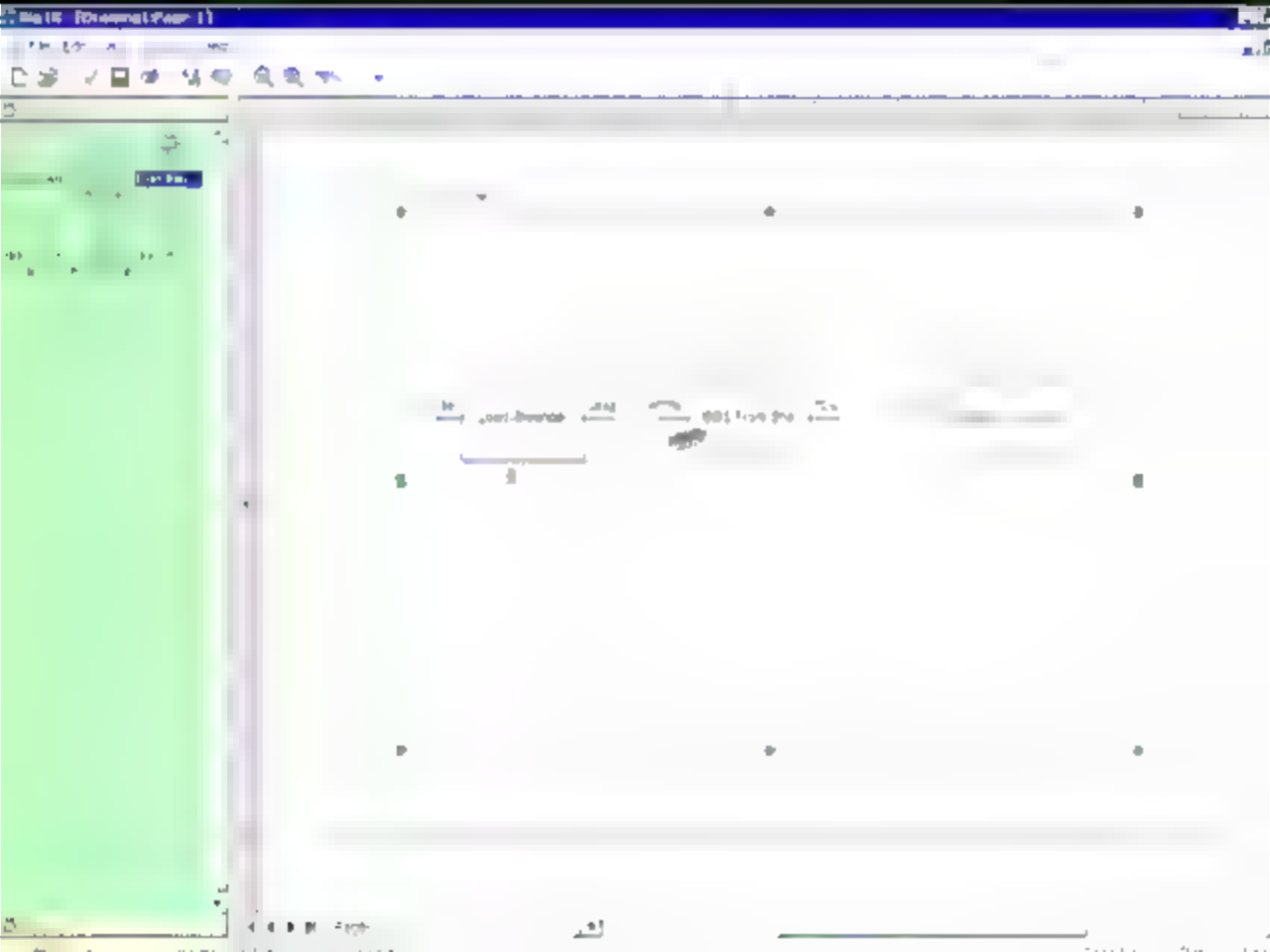


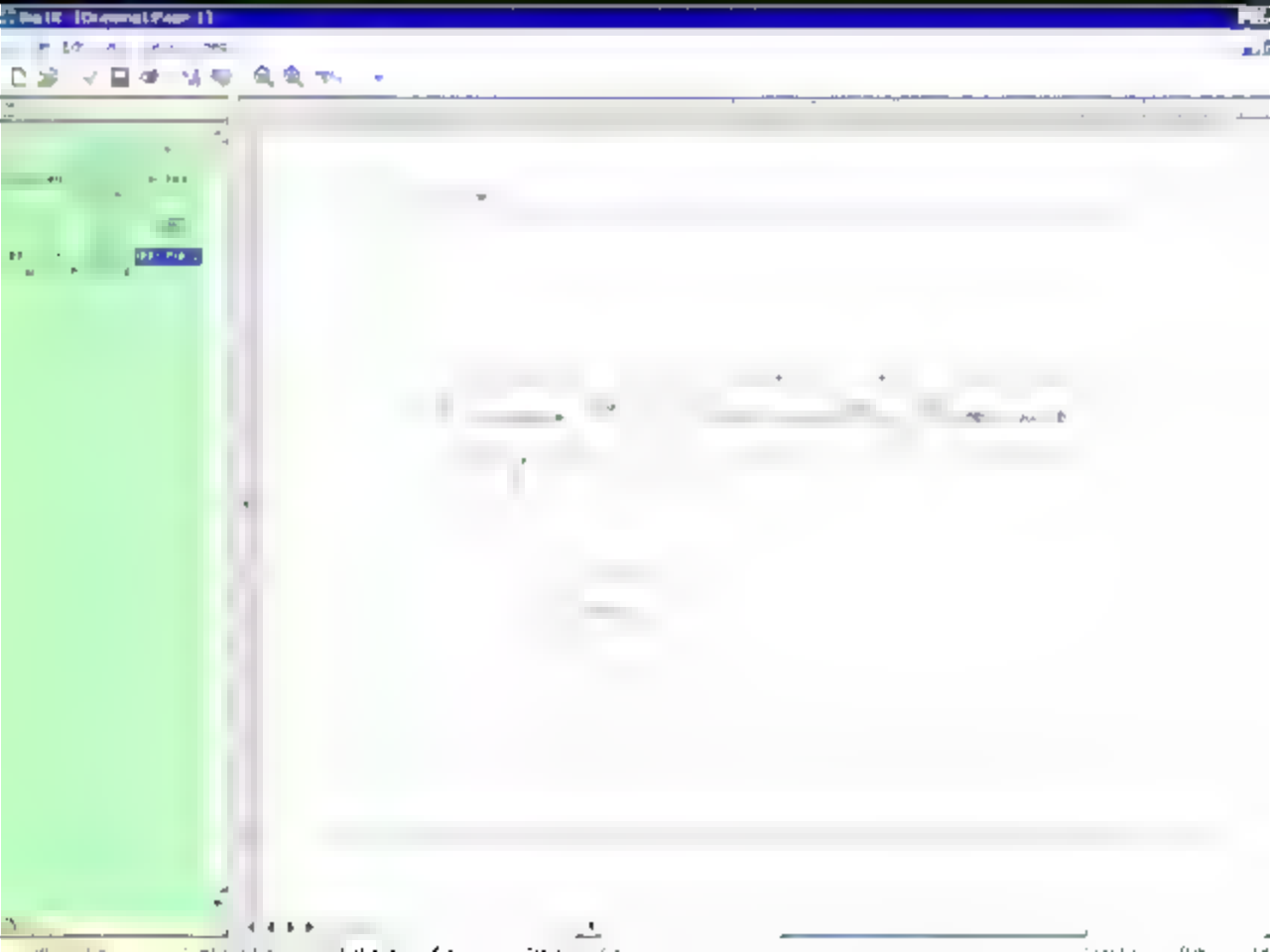
Note: Demo best view at 800x600 full screen.

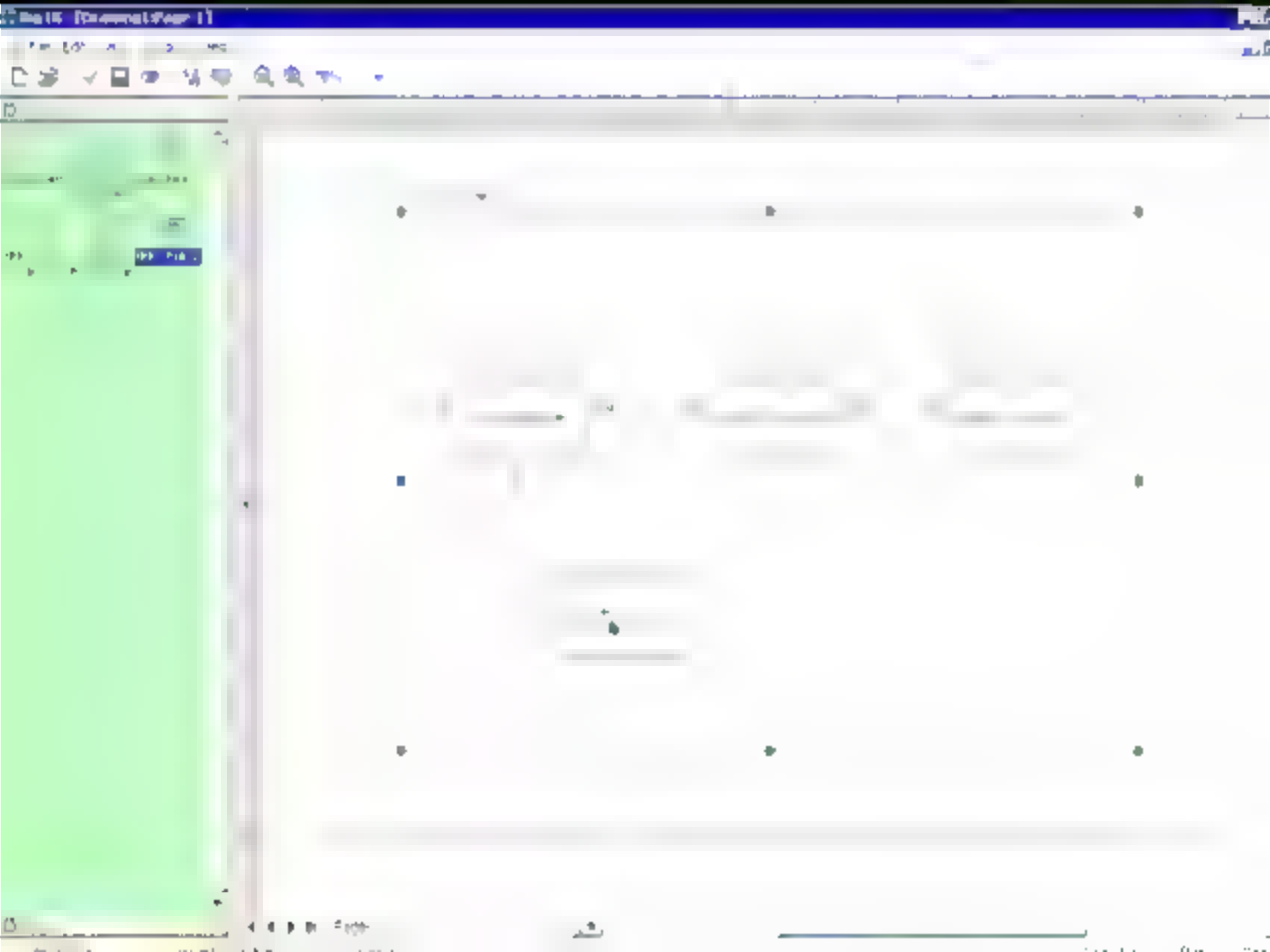


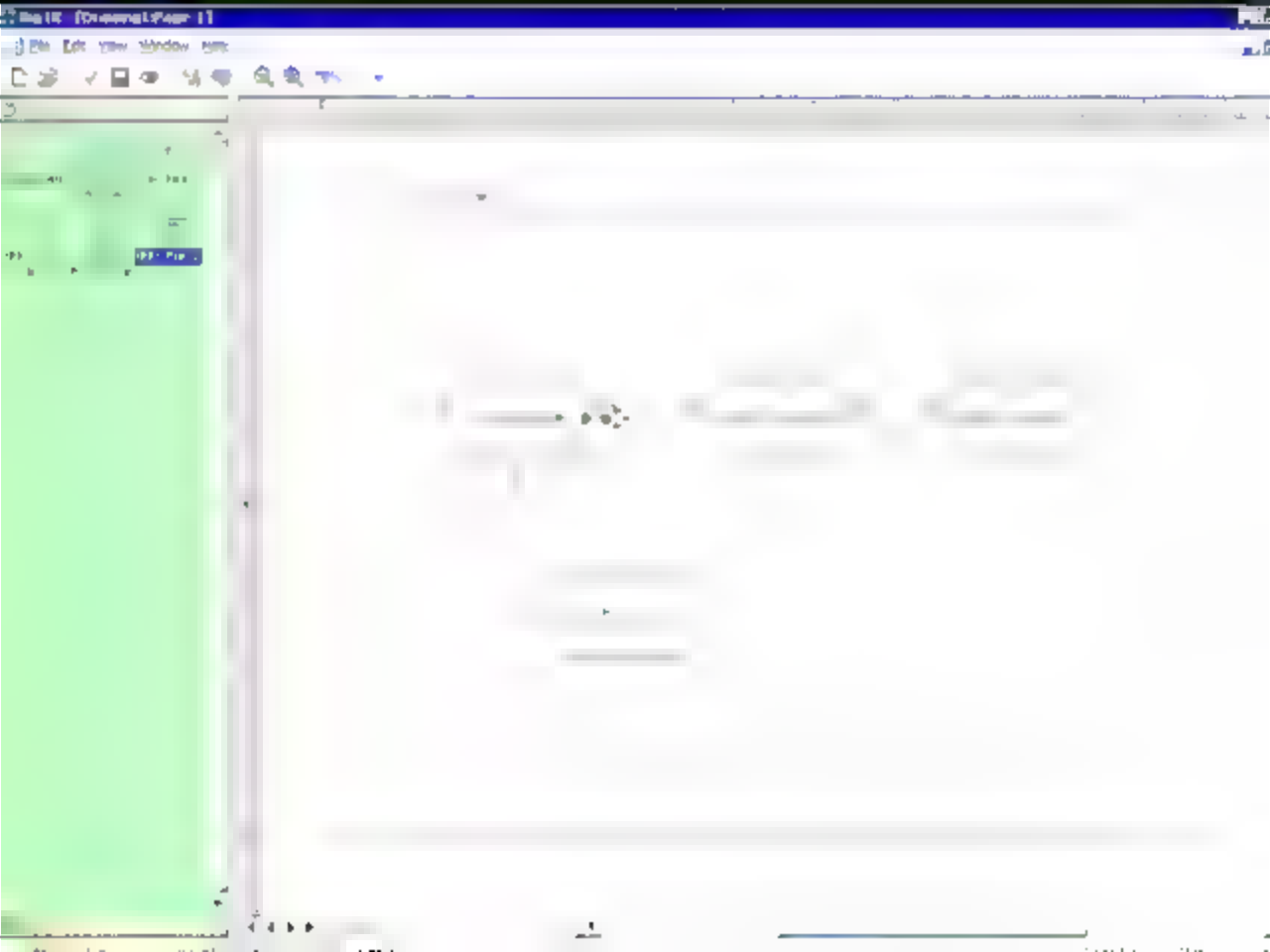


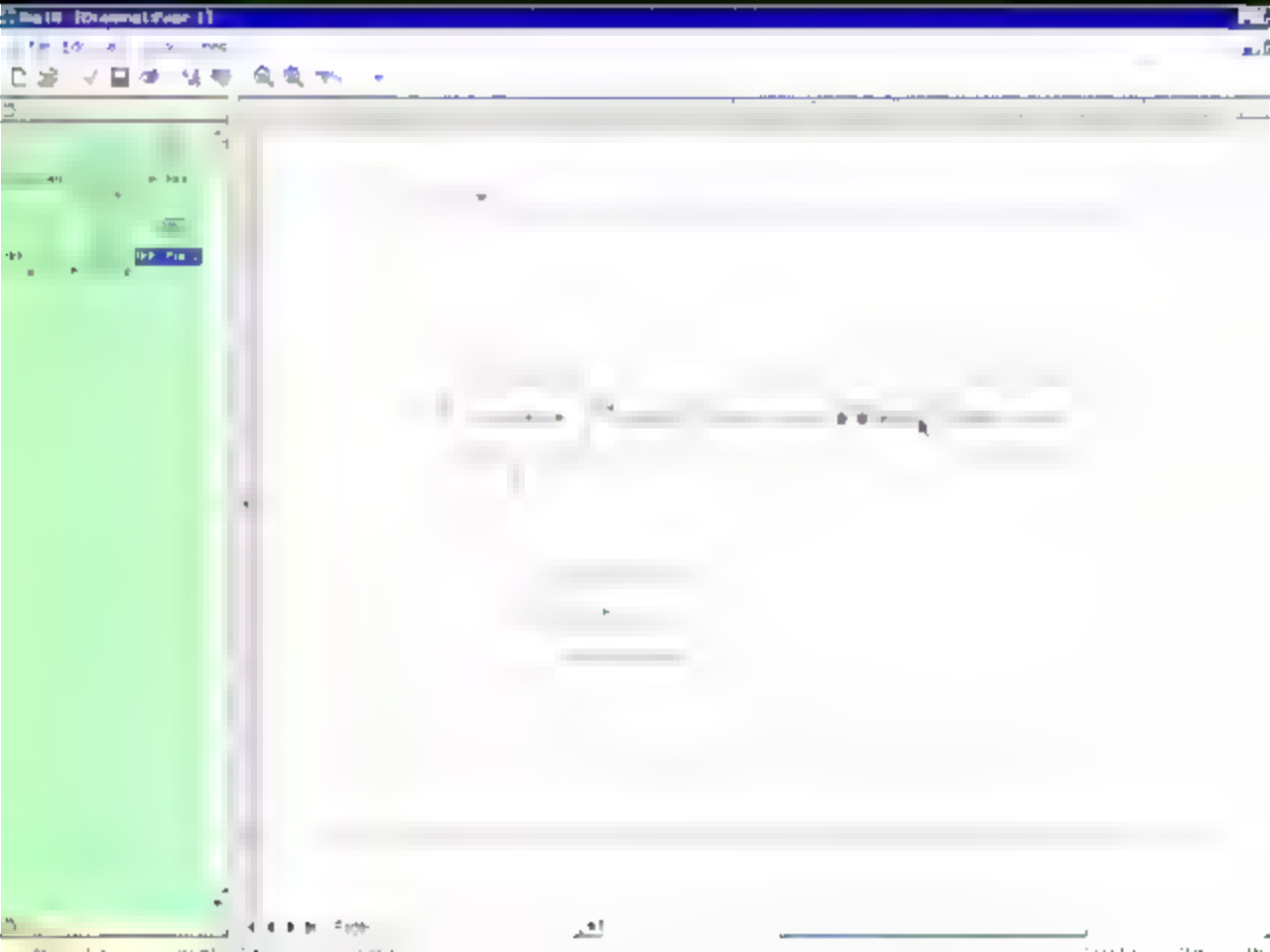


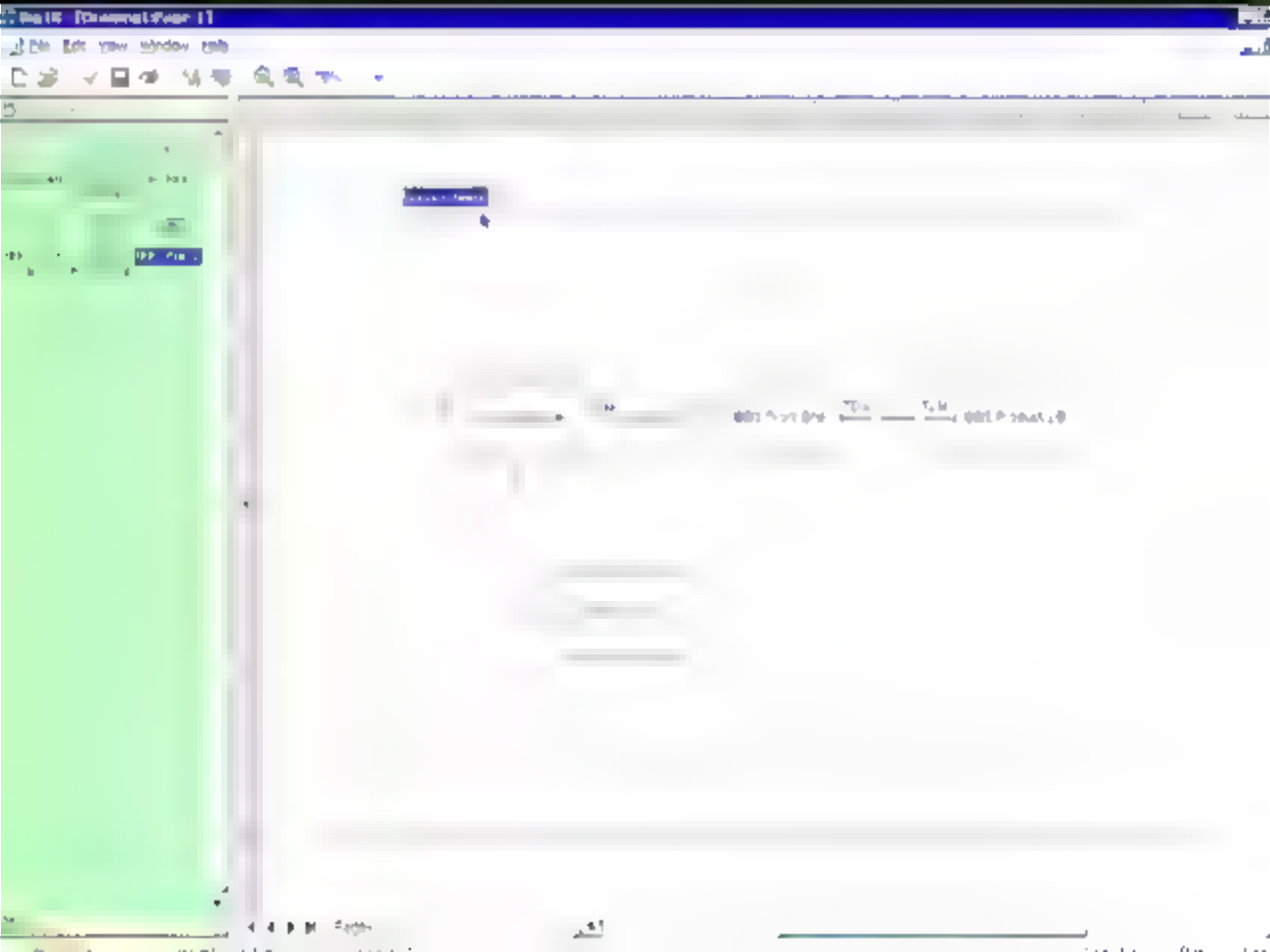


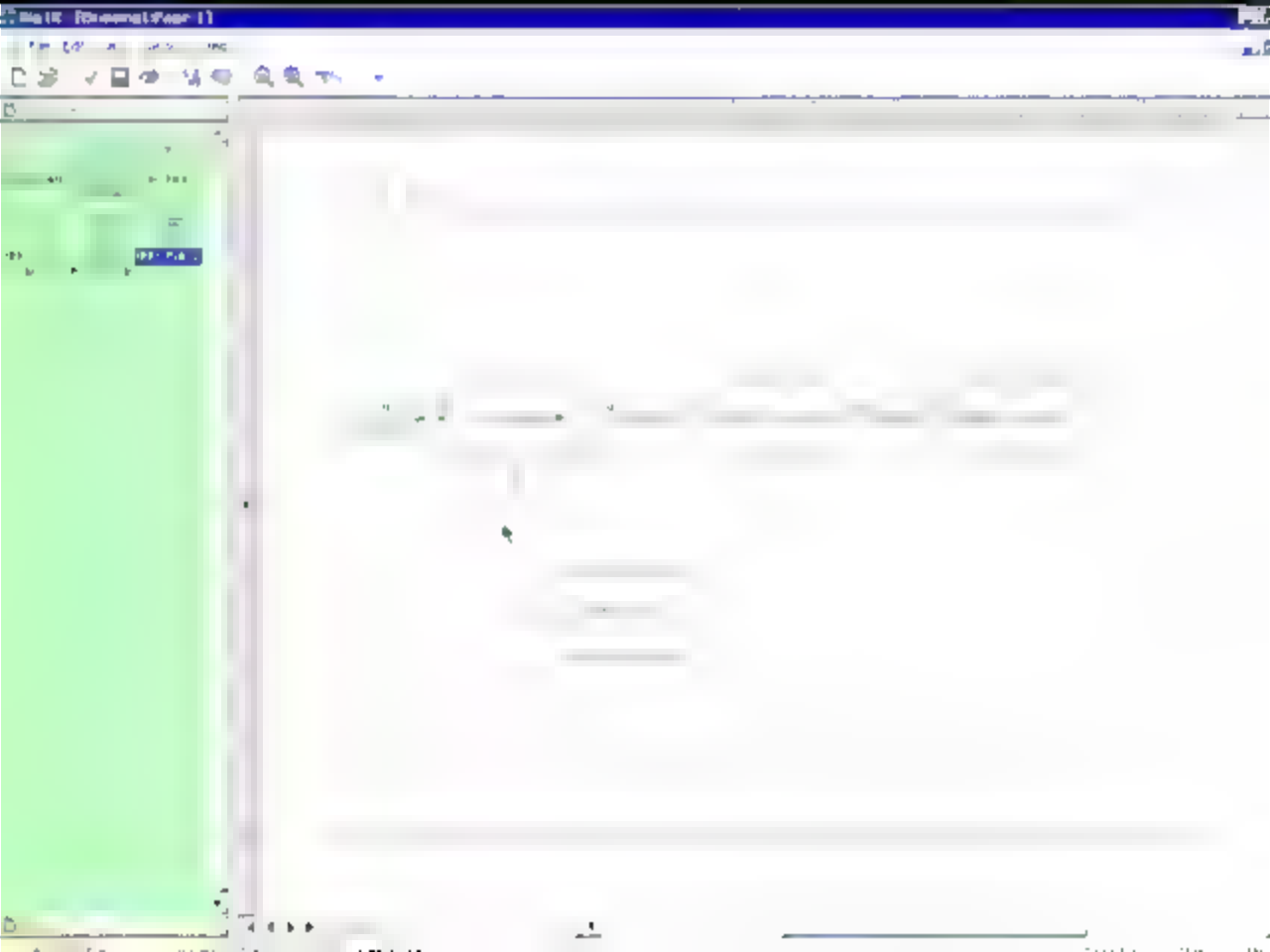












What's the BIG deal?

- Service Definition describes the entire service:
 - All Components, their interfaces, and Topology.
- Service Definition is *scale-invariant*.
 - Need not change with deployment size.
- Service Definition provides a namespace and operating environment for creating, provisioning, deploying, and managing.

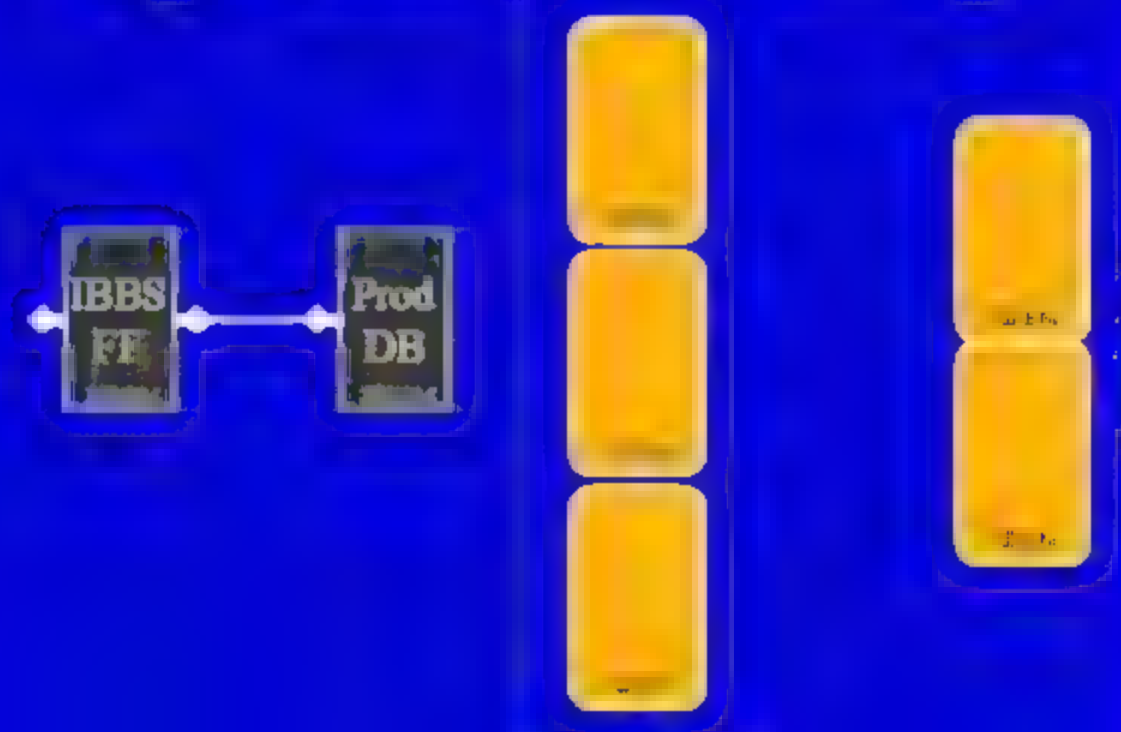
Provisioning a Service

- Services allocate nodes from a *Resource Manager*
 - Nodes are typically machines, including network hardware.
 - Nodes are provisioned by the *Service Hosting Environment*.
 - Every node has a *Node Type*.
- *Node Type* identifies a class of hardware.
 - GUID {1e3dfcbe-fa2f-4111-b86c-999999999999} - PIII, 128MB RAM, 9GB HD.
 - Encodes extrinsic attributes: Node in UltraSecure cage.

Deploying a Service

- A BIG NET Service is deployed by instantiating physical nodes from logical components.
 - Deployment is driven by code called the *Constructor Policy*.
 - Nodes are allocated from a *Resource Manager*.
 - Component instances are recorded in a *State Tracking Service*, part of the BIG Management Service.

Logical to Physical Mapping



Logical to Physical Mapping

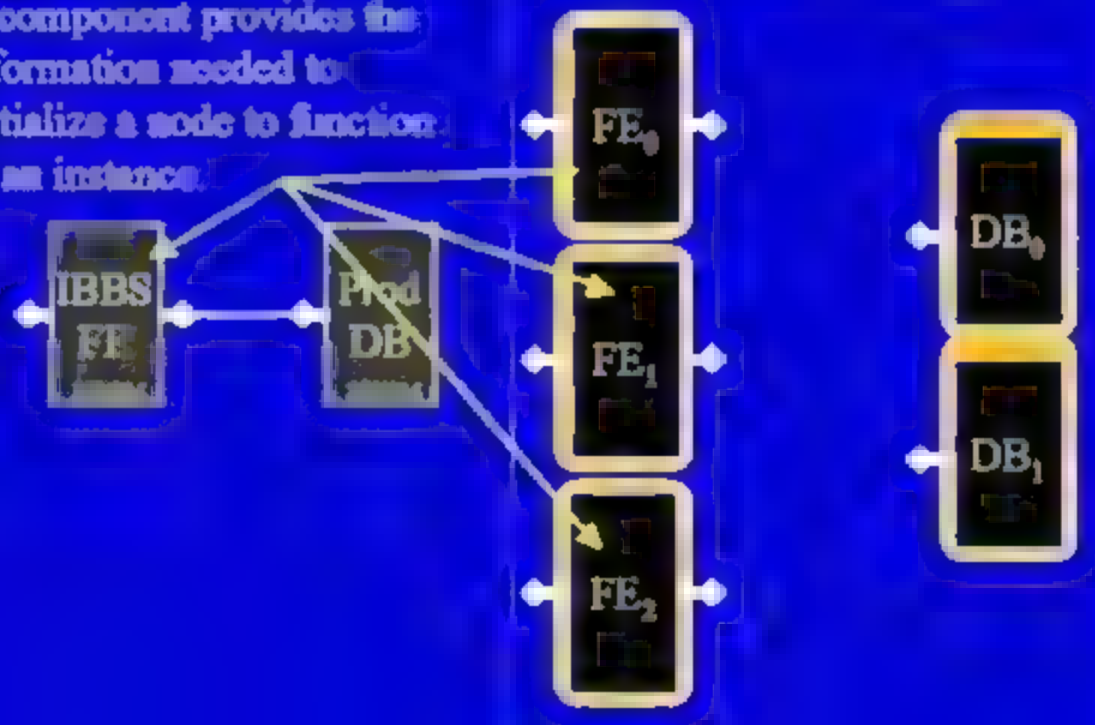
Logical



Physical

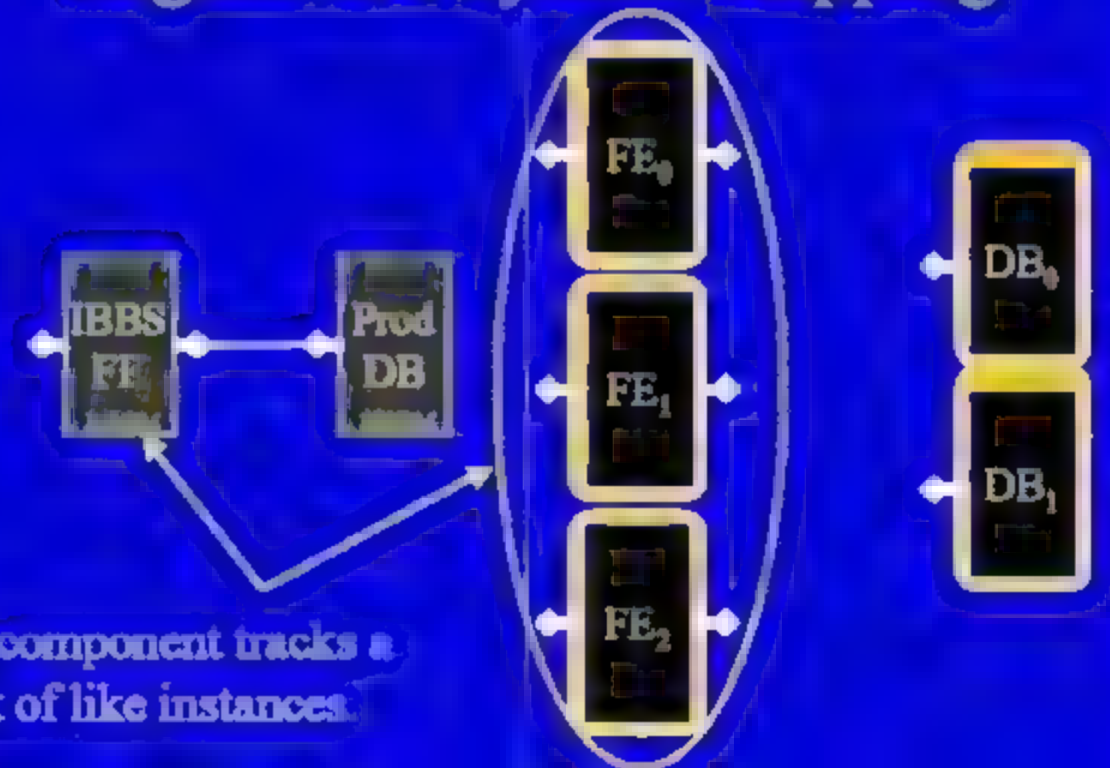
Logical to Physical Mapping

A component provides the information needed to initialize a node to function as an instance.



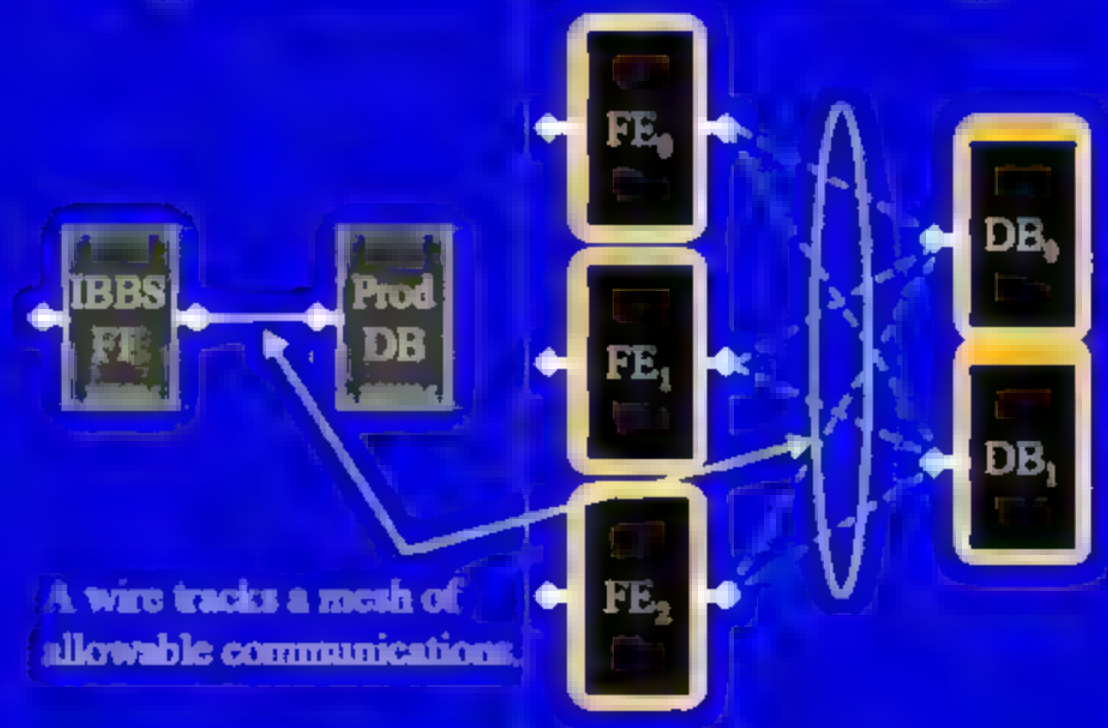
Logical to Physical Mapping

Logical



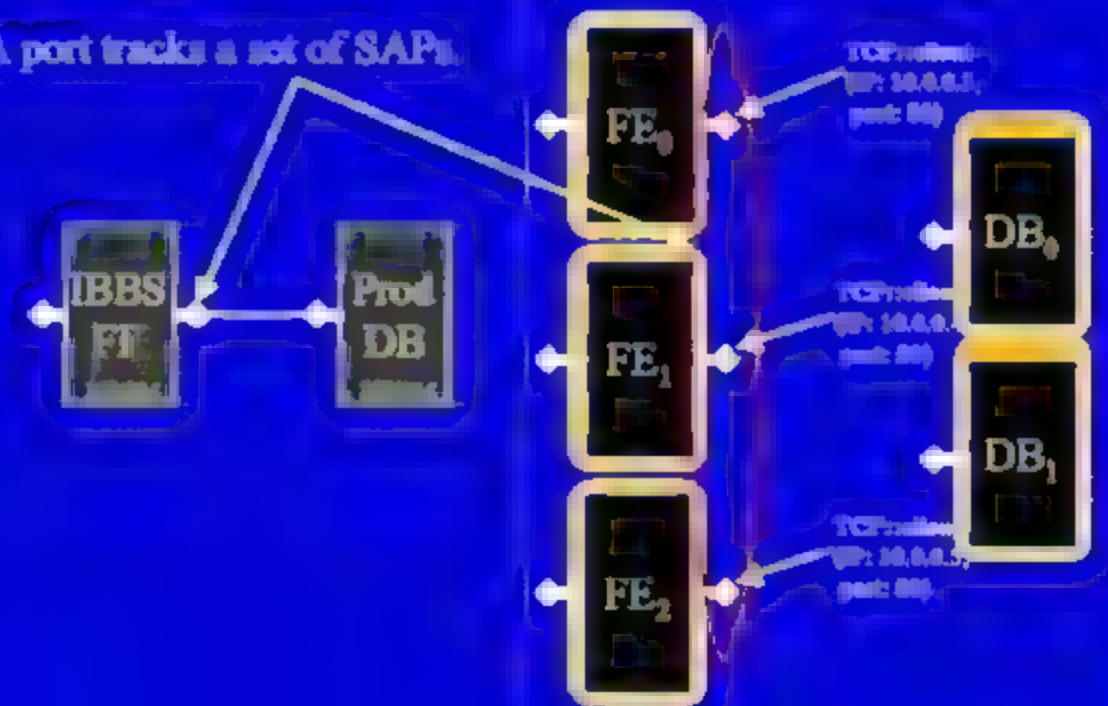
Physical

Logical to Physical Mapping

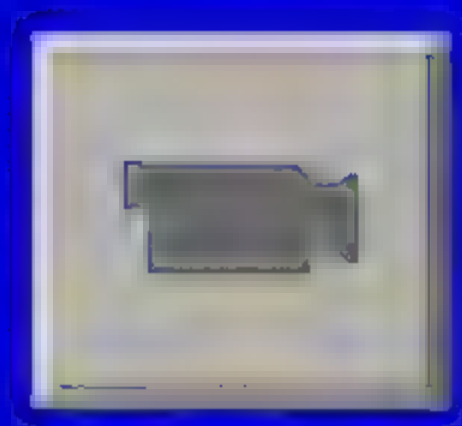


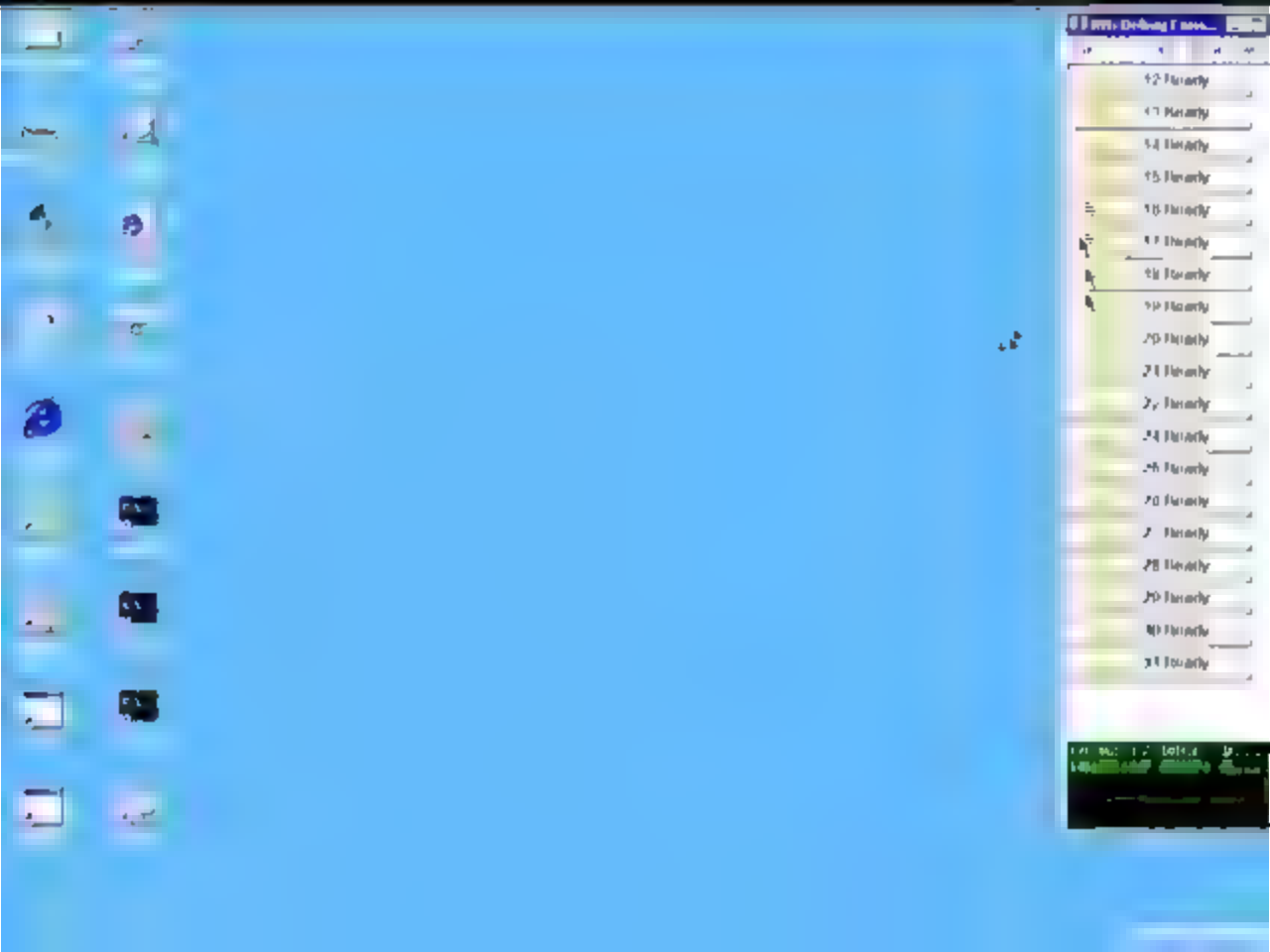
Logical to Physical Mapping

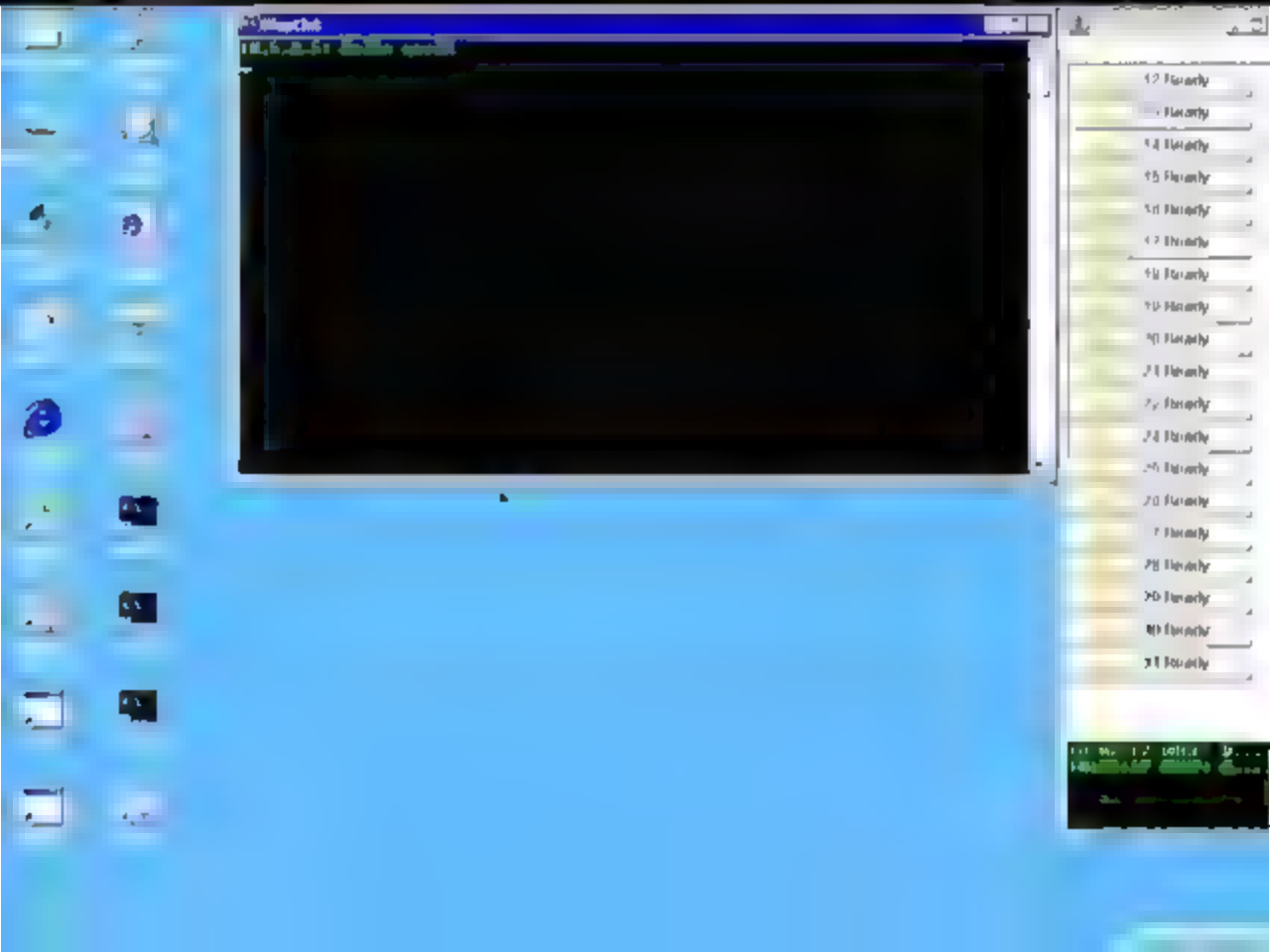
A port tracks a set of SAPs.



Deployment Demo







10.5.10.5: Hello world

Microsoft Windows [Version 5.00.2600]
(C) Copyright 1995-2000 Microsoft Corp.

Microsoft Windows [Version 5.00.2600]
(C) Copyright 1995-2000 Microsoft Corp.

Microsoft Windows [Version 5.00.2600]
(C) Copyright 1995-2000 Microsoft Corp.

1.2.10.5: Hello world

1.3.10.5: Hello world

1.4.10.5: Hello world

1.5.10.5: Hello world

1.6.10.5: Hello world

1.7.10.5: Hello world

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1.9.10.5: Hello world

2.0.10.5: Hello world

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2.4.10.5: Hello world

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2.9.10.5: Hello world

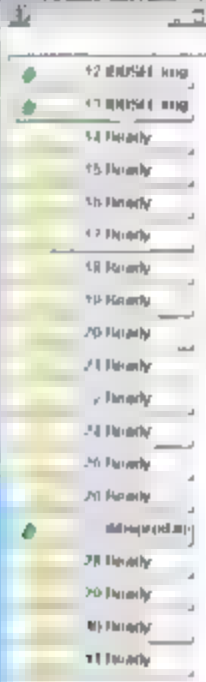
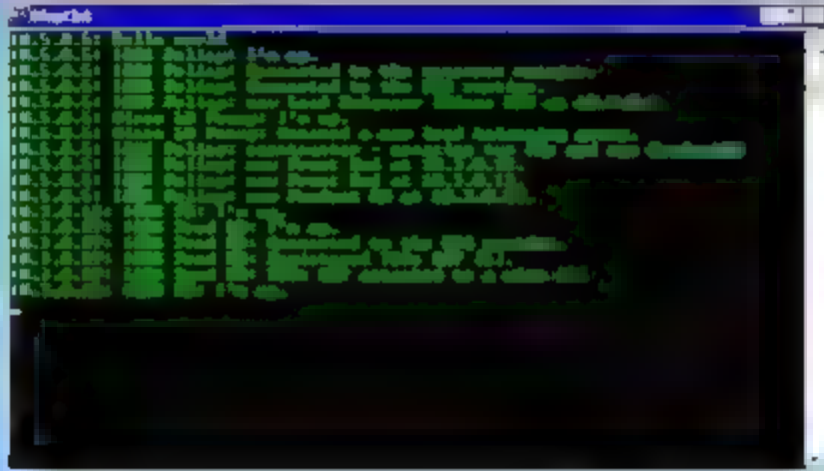
3.0.10.5: Hello world

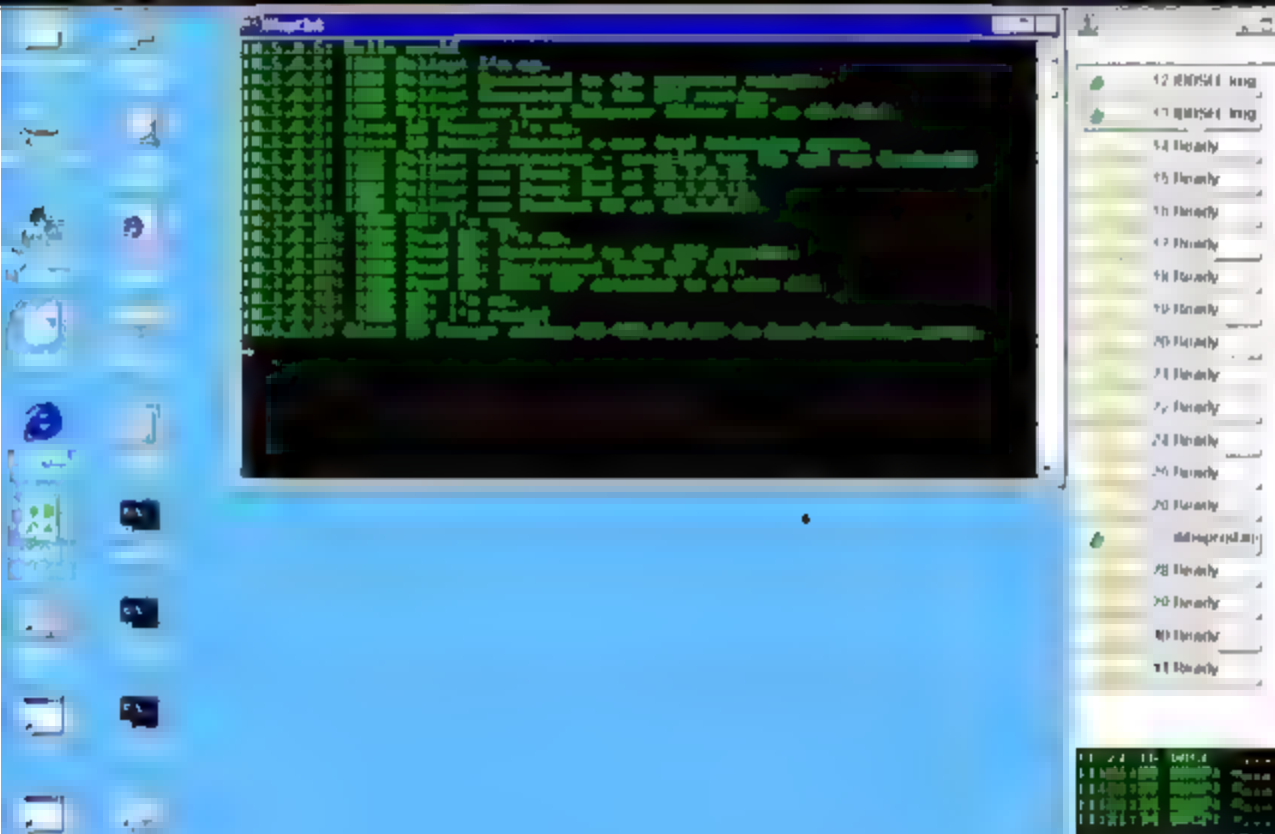
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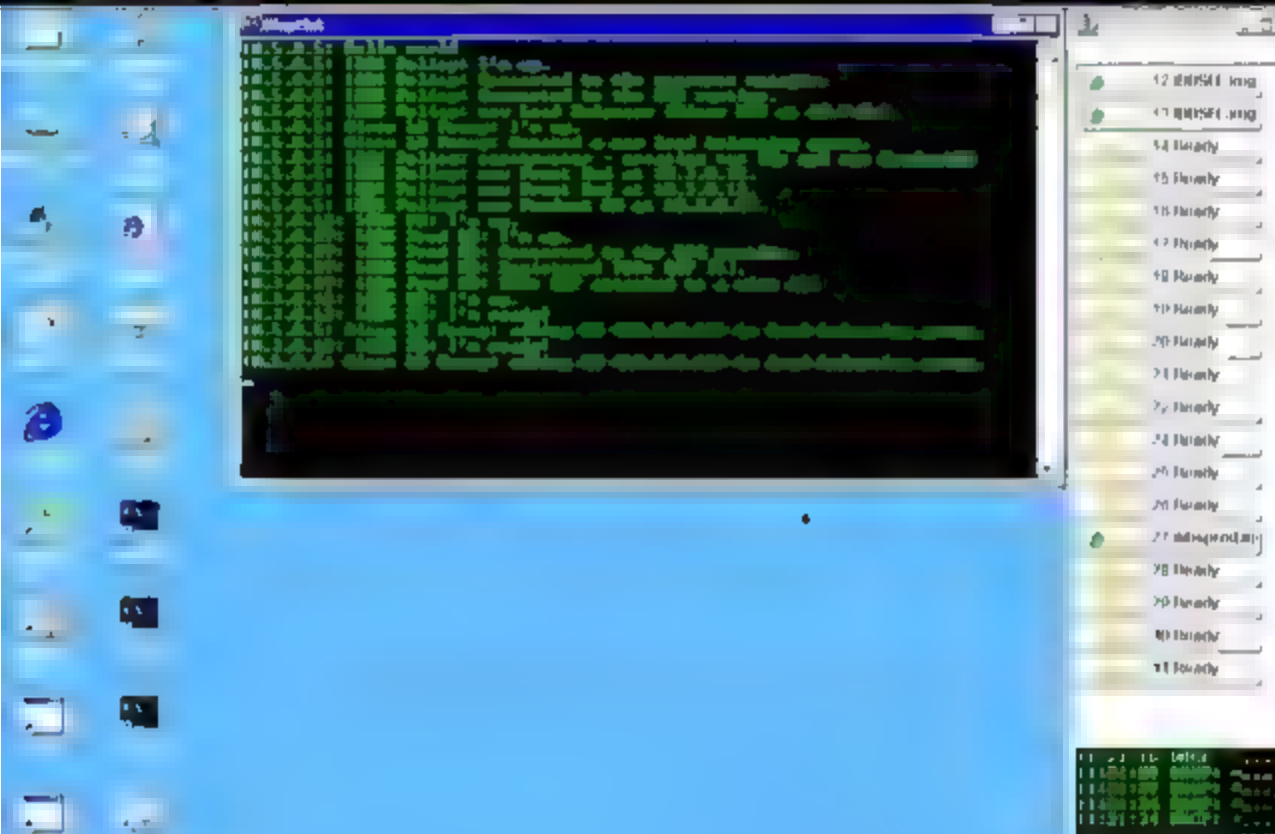


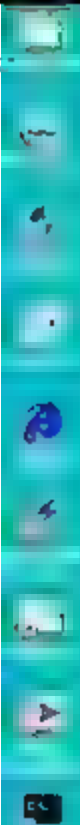
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http://10.0.0.2/ Microsoft Internet Explorer

File Edit View Favorites Tools Help

Address http://10.0.0.2/

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• **Stressors**

Wagner, David 00

YOUNG, D. 1983. *Opinion*.

New IBBS Front-End

```
public void NewFE() {  
    ip = resourcemgr AllocNode(compFE NodeTypeGUID).  
    newFE = compFE.AddInstance(ip).  
}  
  
public void OnSAPAttachHTTPOnFE(SAP s) {  
    ciscold Add(s).  
}
```

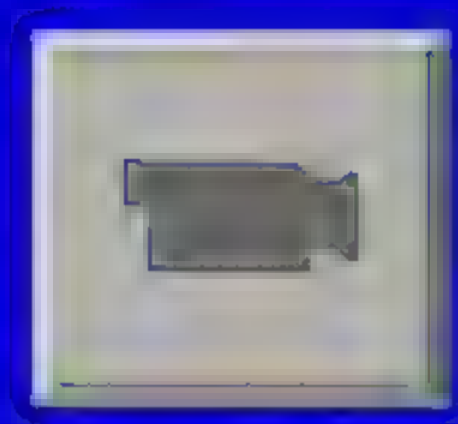
What's the BIG deal?

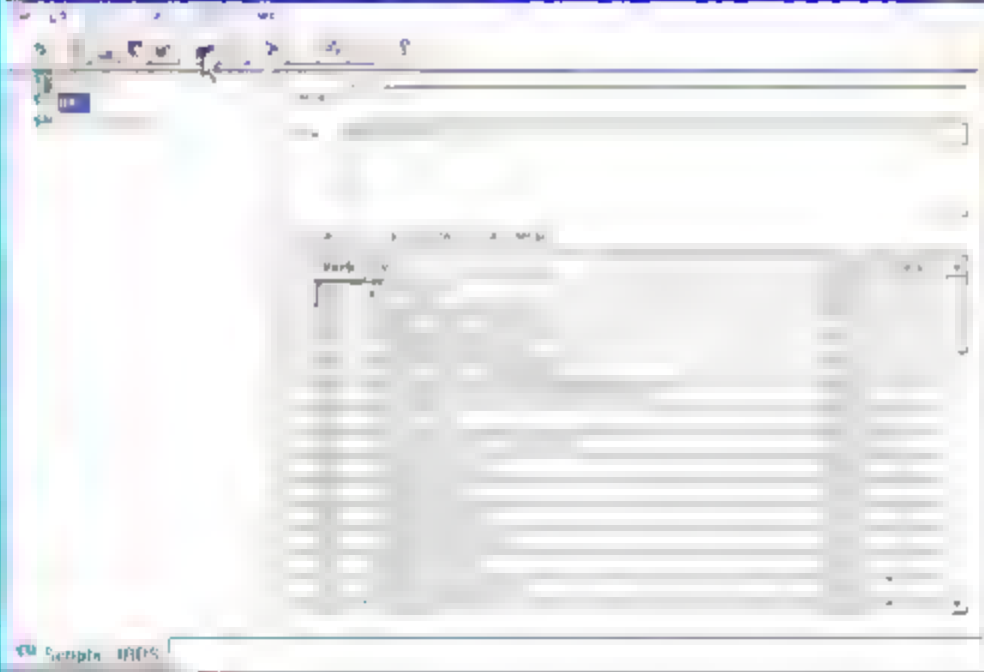
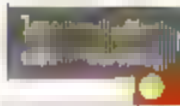
- BIG deployment converts a set of physical nodes into a running NET Service.
- Deployment constructor policy defines the initial configuration of the service.
- Deployment mechanisms:
 - Allocate nodes from a *Resource Manager*.
 - Deploy bits to node using BM/BMCP.
 - Track instances in the *State Tracking Service*.

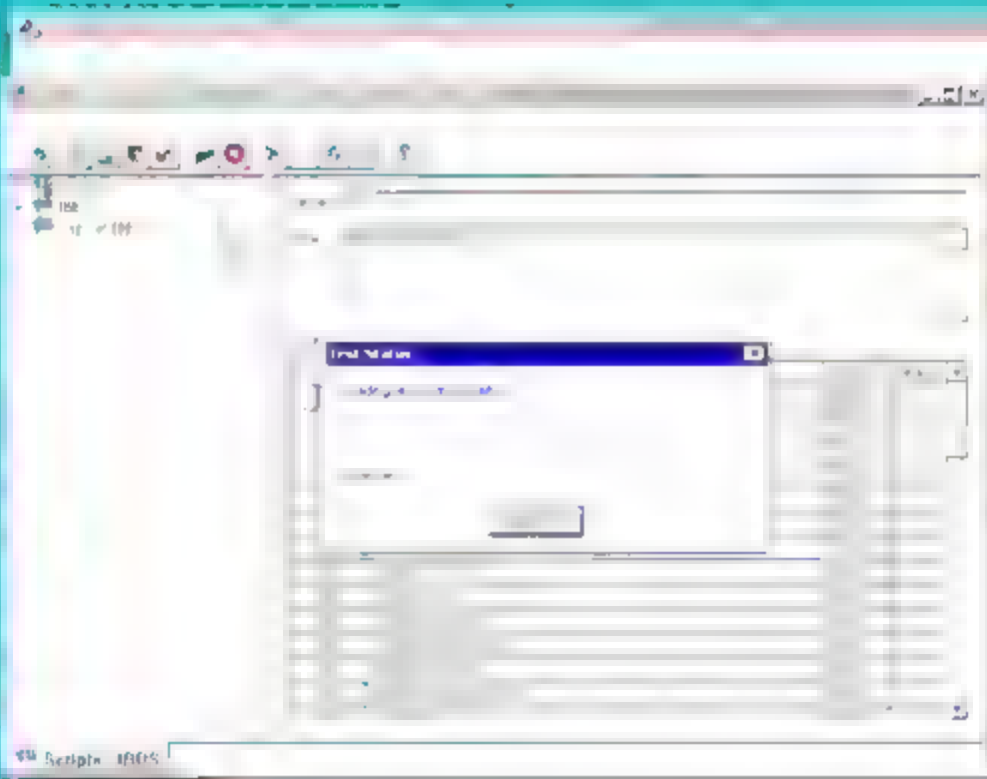
Managing a Service

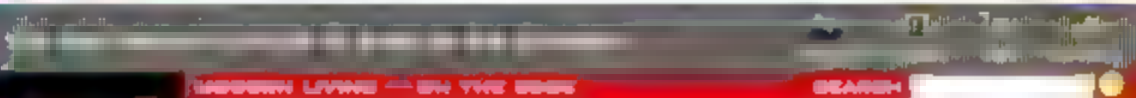
- BIG provides mechanisms for automatic management policy
 - Service growth and scaling.
 - Service evolution.
 - Operational maintenance.
- Policy is written to the scale-invariant Service Definition, but acts on instances.

Management Demo









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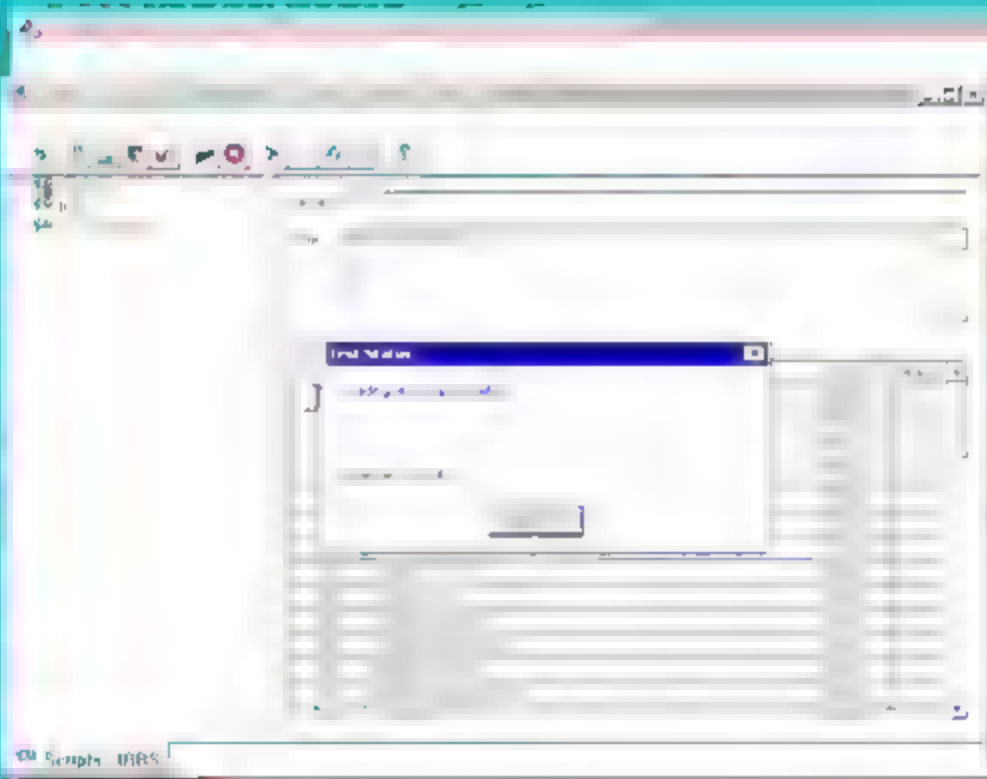
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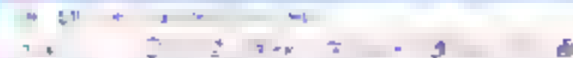
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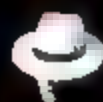
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IBBS Growth

```
public void OnCPUOverload(String ip) {  
    component = service.LookupByIp(ip);  
  
    if (component.Name == "IBBS Front-End") {  
        NewFE();  
    } else if (component.Name == "IBBS Prod") {  
        NewProdSQL();  
    } else {  
        throw new Exception();  
    }  
}
```

What's the BIG deal?

- No human in the loop.
- Policy authored against logical instances in Service Definition.
- Automatic management!
 - Service growth.
 - Evolution.
 - Operation.

The BIG Architecture

Service
Definitions



BIG
Management
Service

Service Definition Object Model

Coordination Primitives

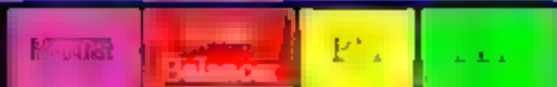
Instance State
Tracking

Physical
Resource Manager

Hardware
Definitions



Drivers



The BIG Deal!

• The BMonitor:

- Enable single-node management.
- Facilitates rapid image deployments.

• The Service Definition Model:

- Defines a namespace for deployment and management.
- Captures scale-invariant attributes of services.

• The BIG Management Service:

- Provides operating environment for management and operations code.
- Tracks state w/ introspection on model and instances.
- Wraps non-PC hardware in device drivers.

Project Status Overview

- Goals for Version 1

- Status Summary

- Drill down on details as desired / needed

- Action Items

Version 1 Goals

- Hand off system-level work to NT Team
 - BMonitor
 - Installation support
- Service definition and infrastructure that supports:
 - Hotmail
 - At least one other MSN property
 - Perhaps MS Exchange server management (with partitioning?)

Status Summary

- BMonitor runs on single chipset / NIC

- Investigating NT Kernel-based code

- Move to PXE supported boot scenarios

- Strong interest from several groups in MS

- Hold offsite in Dec / Jan timeframe to nail requirements

- Hand off to NT Kernel team

- Installation

- Images built by hand, requires 1 image per component

- Needs 2 boots with SysPrep for SID's

- Hand off to NT Setup & Kernel teams

- Collaborate on requirements with all interested parties

Status Summary (cont'd)

■ Device Support

■ BMonitor for computers

- Rely on NT for broad NIC, disk & chipset support
- Extend health & monitoring functionality

■ Cisco LD

- First cut, needs work (BIG team)

■ Additional devices needed

- Switches
- Other routers
- Network storage (e.g. EMC)

Status Summary (cont'd)

• API's & Protocols

- BMCP, Namespace queries

- Still in flux as design converges

- What are required (kernel-level) vs. additional services?

- Group Membership protocols

- Talking to Bling about Berman's Cornell code

- Nested policy

- Compound components

- Naming issues

Status Summary (cont'd)

- Still at design stage

 - Service definition model

 - Resource management, Sharing & Physical model

 - Reusable Policy & Components

 - Reliability / QoS

 - Orthogonal management

Action Items

■ NT Team

- Take over BMonitor development

 - Support PXE boot

 - Multicast support for scalability

 - MTFIP for PXE

 - PCast or ? for NT images

 - Features from BIG, Apps/Data Center, SMS.

- Installation tools

 - Create and manage images

 - Base Image + apps + patches

 - Naked & repurposed machine scenarios

Action Items (cont'd)

• BIG team

- Host NT Deployment/Repurposing offsite

- Finish design work

 - Requirements driven by Apps/Data Center, MSN, etc.

 - Implement and test

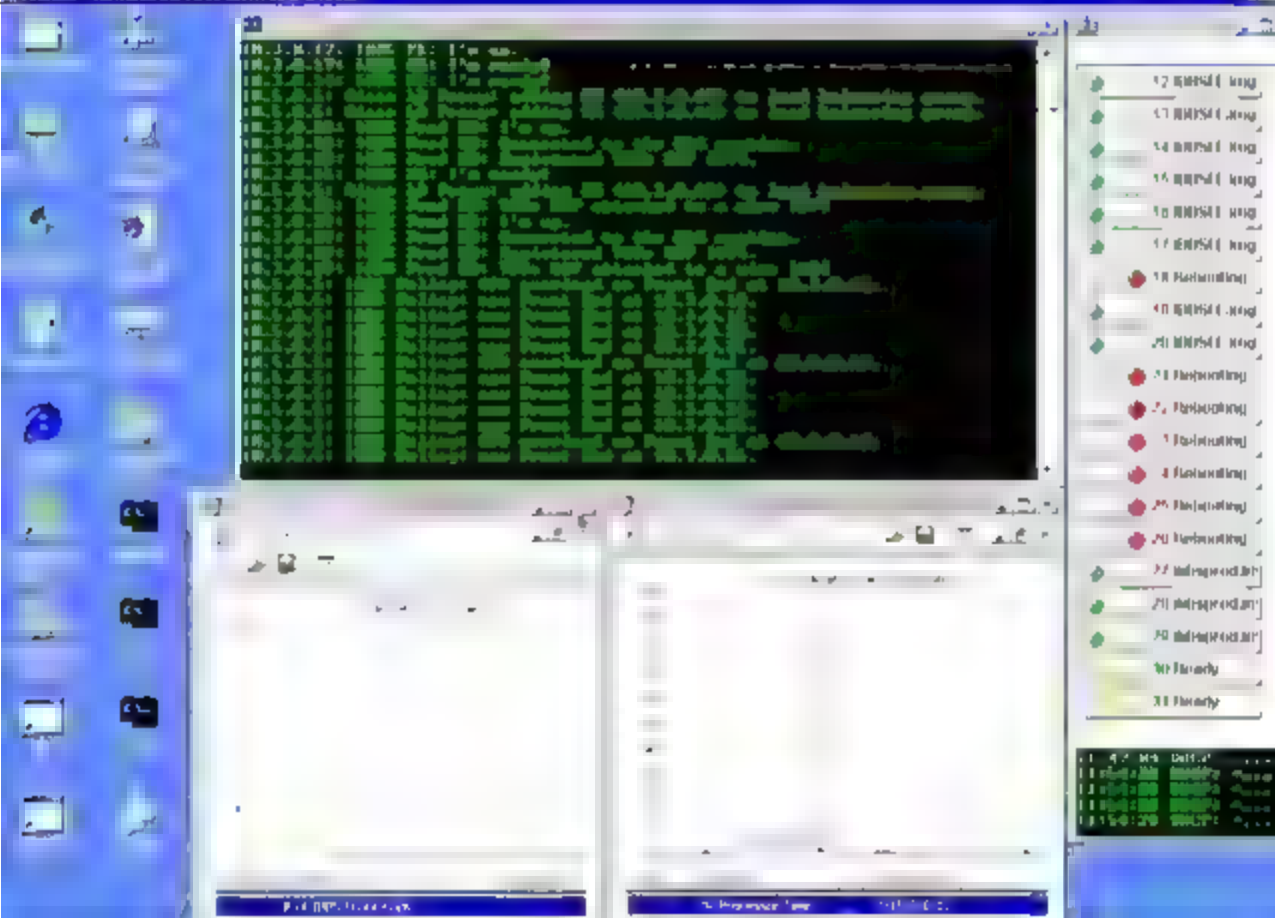
- Work with NT team on BMonitor & Install req's

- Manage scaled versions of services

 - Hotmail

 - At least one other MSN service

 - ITG Exchange Server farm



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